EXHIBIT 6

D&B ENGINEERS AND ARCHITECTS, P.C.

330 Crossways Park Drive, Woodbury, New York 11797
516-364-9890 • 718-460-3634 • Fax: 516-364-9045 • www.db-eng.com

August 6, 2019

Lisa Cairo, Esq.
Jaspan Schlesinger, LLP
300 Garden City Plaza, 5th Floor
Garden City, NY 11530

Re: TOH vs United States of America, et al.
16-cv-3652

Dear Ms. Cairo:

As requested, D&B Engineers and Architects, P.C. (D&B) has prepared this expert report in support of the above referenced action relating to the design and construction of the packed tower aeration system (PTAS) for treatment of groundwater contamination for Wells 7A, 8A, and Well 13 in the Levittown Water District (LWD) owned by the Town of Hempstead Department of Water ("TOH"). The report has been prepared by William Merklin, P.E., Senior Vice President at D&B. Mr. Merklin was also the Project Manager responsible for the design of the PTAS.

Starting in 2012, routine water quality samples began to exhibit low levels of contamination. By the middle of 2013, the contamination levels increased to concentrations which caused the Town to remove Wells 7A and 13 from service. Since the continued operation of these wells was critical to meet the demands of the Levittown Water District, the design and construction of a treatment facility was required. To address this need, the Town retained D&B to prepare the necessary plans and specifications for their use in procuring bids for construction of the treatment facilities. Since PTAS is a common treatment process for the removal of the detected contaminants, it was determined to be the best choice for implementation in this case.

Qualifications

This report was prepared by William Merklin, P.E., Senior Vice President of D&B Engineers and Architects, P.C. (D&B). Mr. Merklin was the Project Manager responsible for the preparation of the Design Report and Contract Plans and Specifications for the subject treatment facility. He has over 28 years of experience in the design and construction of water treatment facilities. He has designed numerous water treatment facilities on Long Island, including packed tower aeration systems similar to the subject treatment facility. Mr. Merklin's corporate resume is attached as Exhibit A.

D&B has designed and implemented over 20 granular activated carbon (GAC) and PTASs for water suppliers in Nassau County. This includes the design and construction of PTASs for the following water suppliers:

- TOH – Uniondale Water District, East Meadow Water District, Bowling Green Water District Roosevelt Field Water District and Levittown Water District
- Albertson Water District

- City of Glen Cove
- Jericho Water District
- Manhasset-Lakeville Water District
- Village of Mineola
- Port Washington Water District
- Water Authority of Great Neck North
- Village of Williston Park

Relevant Regulatory Requirements

A public water supplier is required to comply with all requirements of the New York State Department of Health Sanitary Code (Sanitary Code). The requirements for subject contaminants require a water supplier to begin the process of planning for the implementation of treatment when a contaminant concentration exceeds 50 percent of the Maximum Contaminant Level ("MCL"). In this case, when any one of the contaminants of concern exceeded 2.5 parts per billion ("ppb"), TOH was required to begin the planning and design of a groundwater treatment facility. The Sanitary Code also requires a public water supplier to remove a well from service when the concentration of one of these contaminants is 80 percent or higher than the MCL.

The Sanitary Code requires the well source capacity for a public water supply to be capable of meeting the Maximum Day Demand with the largest well out of service. This requirement provides redundancy in the overall water supply system to ensure that adequate flows and pressures can be maintained under the worst-case conditions. At the time of the evaluations of the subject wells, the historical Maximum Day Demand in the Levittown Water District was 11.11 Million Gallons per Day ("MGD"). The total actual capacity of all the operating wells, including Wells 7A, 8A and 13, was 13.55 MGD. (See Table 1.) The loss of any of the subject wells reduced the total capacity of the operating wells to 9.93 MGD. (See Table 1.) At that point in time, if the largest remaining well was to be removed from service for any reason, the total capacity of the remaining wells would have been reduced to 7.90 MGD. Since this is less than the historical Maximum Day Demand, the LWD would have been operating out of compliance with the Sanitary Code when Wells 8A and 13 were removed from service. Therefore, the operation of Wells 7A, 8A, and 13 was required to meet the demands of the LWD in accordance with the Sanitary Code.

Table 1 below summarizes the well capacities at the time Wells 8A and 13 were removed from service:

Table 1 –
Summary of Well Capacities in Levittown Water District

Well No.	Actual Capacity (MGD)
1A	0.55
2A	2.03
5A	1.34
6B	1.99
7A	1.71
8A	1.59
12	1.78
13	2.03
14	0.54
Total	**13.55**
Total with largest well out of service	**11.52**
Total with Wells 8A and 13 and largest remaining well out of service	**7.90**

Design and Implementation of PTAS for Wells 7A, 8A and 13

Wells 7A and 8A are located on Bowling Lane in Levittown, NY. Prior to commencing with this project, those wells did not require any treatment for contaminant removal.

Well 13 is located at the intersection of Entry Lane and Wantagh Avenue in Levittown, NY. Prior to commencing with this project, that well did not require any treatment for contaminant removal.

In 2013, the water quality in Wells 7A and 8A had exhibited trace concentrations of volatile organic compounds (VOC). Between the beginning of 2013 and the initial preparation of the Design Report for Packed Tower Aeration System for Wells 7A and 8A, dated August 2014 and revised February 2016 ("Design Report for Wells 7A and 8A"), increasing concentrations of 1,1 dichloroethane (1,1 DCA), 1,1,2 trichloro-1,2,2–trifluoroethane (Freon 113) and tetrachloroethene (PCE) were observed at those wells. Samples collected on May 14, 2013 exhibited concentrations of Freon 113 approaching the maximum contaminant level (MCL) of 5.0 ppb.

Starting in January 2012, the water quality in Well 13 had exhibited trace concentrations of VOCs. Between the beginning of 2012 and the initial preparation of the Design Report of Packed Tower Aeration System for Well 13, dated August 2014 and revised February 2016 ("Design Report for Well 13"), increasing concentrations of 1,1,2 trichloro-1,2,2–trifluoroethane (Freon 113) were observed. Samples collected on July 17, 2013 exhibited concentrations of Freon 113 approaching the maximum contaminant level (MCL) of 5.0 ppb.

As discussed above, a public water supplier must comply with the Sanitary Code with respect to MCLs. In this case, TOH was required to remove Well 8A from service when the concentration of any of the subject contaminants exceeded 4.0 ppb. Based on these requirements and because of the potential for an MCL violation, TOH removed Well 8A from service. With respect to Well 13, TOH was required to remove Well 13 from service when the concentration of any of the subject contaminants exceeded 4.0 ppb. Based on these requirements and because of the potential for an MCL violation, TOH removed Well 13 from service.

In June 2013, D&B was retained by TOH to prepare a design report, as well as detailed plans and specifications, and obtain required permits and provide services during construction for a treatment facility suitable to remove the contamination at Wells 7A, 8A, and 13. A copy of D&B's proposal, dated June 13, 2013, is attached hereto as Exhibit B.

During the preparation of the Design Report for Wells 7A and 8A and Well 13, D&B performed a routine 2-mile radius search in an effort to identify the possible source of VOC contamination. The identification of a source is an important step to developing the design criteria for the proposed treatment facility. No potential sources were identified within the radius of the search. However, the plume ("Grumman Plume") originating from the Northrop Grumman Systems Corporation site in Bethpage (ID# NYD002047967) ("Grumman Site") was known to exist upgradient approximately 2.5 miles north-northeast from Wells 7A, 8A, and 13. The respective Design Reports include an evaluation of the Grumman Plume as the potential source of contamination of Wells 7A, 8A, and 13. The data available at the time of the report preparation indicated the presence of the same constituents in the Grumman Plume as those observed in Wells 7A, 8A, and 13. This data is summarized and included in the Design Reports attached as Exhibits C and D

Based on the publicly available monitoring well data, the maximum VOC concentration observed in the Grumman Plume was 420 ppb of trichloroethene (TCE). Based on good engineering practice, a water treatment facility must be designed to treat the highest possible future contamination concentration anticipated in order to ensure continuous operation of the LWD public water supply wells. Therefore, the PTAS was designed to treat a maximum concentration of 420 ppb of TCE.

Having identified the anticipated contaminants and estimating the potential maximum concentrations which could impact the raw water in Wells 7A, 8A, and 13, D&B evaluated alternatives for treatment. Because of the high concentration of TCE observed in the plume monitoring wells and the presence of Freon 113, granular activated carbon (GAC) filtration was not considered a viable option for treatment. This conclusion is based on data provided by a leading GAC media manufacturer, Calgon Carbon Corporation (Calgon). Based on the assessment of D&B, it was determined that the design concentration of TCE would require frequent carbon changes, which would both periodically disrupt the operation and significantly increase the operation cost of the treatment facility. Additionally, it is our understanding that GAC has a very low affinity for removing Freon 113, rendering it ineffective for removal of this contaminant. Therefore, it is our opinion to a reasonable degree of certainty that the best available technology at the time of the preparation of the Design Reports was PTAS. Having designed other VOC treatment facilities prior to the subject facility, D&B was already familiar with the limitations of GAC for treatment of the contaminants involved with Wells 7A, 8A, and 13. For this reason, the Design Reports did not include a discussion of the treatment selection process.

Wells 7A and 8A are located within a residential neighborhood. Therefore, a goal of this project was to design the treatment facility to limit the visual impact to the surrounding community. To achieve this, the towers were installed inside of a building enclosure. Additionally, the design included the following features to reduce the overall height of the facility:

- A two-stage treatment system was utilized to effectively cut the overall height nearly in half.
- Treated water clearwells were constructed fully below grade.
- The tower bottoms are fully open, reducing the height of the tower sumps.

The full details of the final design of the Wells 7A and 8A treatment facility are included in contract plans and specifications dated February 2015 attached as Exhibit E.

The total cost for design and construction of the PTAS for Wells 7A & 8A was $5,560,300.67. Based on our experience with the cost for similar treatment facilities constructed in Nassau County, the cost for this facility is considered typical and reasonable.

The Well 13 site is located adjacent to a four-lane thoroughfare in the Levittown Community. Because of this location, TOH did not have the same concerns with respect to the visual impact to the surrounding community as with the Wells 7A and 8A site. Therefore, the packed tower for Well 13 was not installed within a building enclosure. Because the tower was not within an enclosure and due to the significant site constraints, a single tower was selected. The design included the following features to reduce the overall height of the facility to the extent possible:

- Treated water clearwell was constructed fully below grade.
- The tower bottom is fully open, reducing the height of the tower sump.

The full details of the final design of the Well 13 treatment facility are included in the contract plans and specifications dated November 2014 attached as Exhibit F.

The total cost for design and construction of the PTAS for Well 13 was $2,780,001.48. Based on our experience with the cost for similar treatment facilities constructed in Nassau County, the cost for this facility is considered typical and reasonable.

Conclusions

To summarize the analyses presented above, we provide the following conclusions to a reasonable degree of our engineering certainty:

- Since the implementation of these treatment facilities, the water delivered to the distribution system has met all requirements of the Sanitary Code. In fact, the water delivered from these facilities has consistently exhibited non-detectable concentrations of the subject contaminants since the implementation of the PTAS.

- The treatment facilities installed at Wells 7A, 8A, and 13 have, therefore, achieved the goal of meeting the Sanitary Code requirements.
- The finished treatment facilities have achieved the previously discussed goal for mitigating the negative visual impact of the facility within the residential neighborhood.
- The cost for the design and implementation of the treatment facilities are considered to be both typical and reasonable.

<u>Compensation</u>

Mr. Merklin's hourly rate for review and testimony is $350.00.

<u>Other Cases in Last 4 Years</u>

Mr. Merklin has not testified for any deposition and/or trial in the last four years.

The above information has been provided to the best of my recollection and knowledge. If you have any questions, please feel free to call me.

Very truly yours,

William Merklin, P.E.
Senior Vice President

WDM/MRDt/kb
Enclosures
♦3530\WDM080619LC-Ltr

<u>List of Exhibits</u>

- A – Resume of William Merklin, P.E.
- B - D&B proposal dated June 11, 2013
- C - Wells 7A and 8A Design report dated August 2014 (Revised February 2016)
- D – Well 13 Design Report dated August 2014 (Revised February 2016)
- E – Wells 7A and 8A Contract Plans and Specifications dated February 2015
- F – Well 13 Contract Plans and Specifications dated November 2014

EXHIBIT A

WILLIAM D. MERKLIN, P.E.

Corporate Title
Senior Vice President

Education
Manhattan College, Master of Engineering (Environmental) - 1991

Manhattan College, Bachelor of Engineering (Civil) - 1989

Professional Licenses
New York
California

Professional Societies
American Water Works Association (AWWA)

Long Island Water Conference (LIWC)

Years' Experience
28+

Office Location
Woodbury, NY

Contact
bmerklin@db-eng.com

Professional Experience

As Senior Vice President of D&B, Mr. Merklin has been with the firm since 1995 and currently manages both the Water Supply Division and the Civil Engineering Division. Responsible for overseeing a wide range of assignments for municipal and private clients, Mr. Merklin offers extensive experience that encompasses the study, planning, design, permitting and construction of publicly funded infrastructure. Tasks involved as part of these projects have included technical and economic evaluations; preliminary engineering; contract document preparation; construction cost estimating; preparation of engineering reports; regulatory compliance, permitting and applications; technical evaluations; and reporting to the client.

Mr. Merklin has accrued decades of experience serving as the Engineer of Record for villages and water suppliers throughout Nassau County, including:

- Albertson Water District (since 1999)
- Glenwood Water District (since 1999)
- Village of Williston Park (since 1965)
- Village of Mineola (since 1997)
- Jericho Water District (since 2019)
- Port Washington Water District (since 1998)
- Village of Old Westbury (since 2016)
- Village of Sands Point (since 1998)
- Westbury Water District (since 1999)

Working with many of Long Island's municipalities and public agencies, Mr. Merklin has honed his expertise in water supply engineering, as well as civil and municipal engineering. This unique experience provides him with invaluable knowledge and expertise that he leverages to meet his clients' expectations and requirements. As such, Mr. Merklin offers proven expertise in the following areas:

Water Supply Engineering

- Water Supply Wells
- Packed Tower Aeration Systems (PTAS)
- Granular Activated Carbon (GAC)
- Advanced Oxidation Process (AOP) for 1,4-Dioxane Removal
- Iron and Manganese Filtration
- Ion Exchange for Nitrate Removal
- Chemical Storage and Handling
- Water Storage Tank Design and Inspection
- Booster Pumping Stations
- Distribution System Piping
- Distribution System Hydraulic Modeling
- Electrical Service
- Standby Generators
- SCADA Systems
- Global Information Systems (GIS)
- Master Plans and Capital Plans
- Annual Water Quality Reports
- Emergency Response Plans

- Vulnerability Assessments
- Cyber Security
- Water Conservation Plans
- Spill Prevention Reports
- Emergency Response Assistance
- Regulatory Compliance Assistance
- Water Rate Studies

Civil and Municipal Engineering

- Roadway Improvements and Resurfacing
- Curb and Sidewalk Replacements
- Drainage Modeling
- Draining Infrastructure Improvements
- Recharge Basins
- Green Infrastructure
- Stormwater Management Plans
- MS4 Permit Compliance
- Dry Weather Outfall Inspections
- Storm Drain Network and Systems Mapping (GIS)
- SWPPP Preparation, Review and Inspection
- Best Management Practices (BMP) Manuals
- Salt Storage Sheds
- Planning Board Reviews
- EPA and DEC Audit Assistance

Through his extensive experience, Mr. Merklin has gained in-depth familiarity of the regulatory requirements that affect water supply and civil engineering projects. His understanding of these requirements ensures that projects obtain local county and municipal approvals in support of construction rights-of-way and easements to create a clear path for project progress. Mr. Merklin is experienced working with the following agencies:

- New York State Department of Environmental Conservation (NYSDEC)
- United States Environmental Protection Agency (USEPA)
- New York State Department of Health (NYSDOH)
- Nassau County Department of Health (NCDH)
- Suffolk County Department of Health Services (SCDHS)
- Westchester Country Department of Health (WCDOH)
- New York State Department of Parks, Recreation and Historic Preservation (SHPO)
- Army Corps of Engineers
- Nassau County Fire Marshal (NCFM)
- Governor's Office of Storm Recovery (GOSR)
- Environmental Facilities Corporation (EFC)
- Federal Emergency Management Agency (FEMA)

EXHIBIT B

DVIRKA AND BARTILUCCI
CONSULTING ENGINEERS

A DIVISION OF D&B ENGINEERS AND ARCHITECTS, P.C.

330 Crossways Park Drive, Woodbury, New York 11797-2015

516-364-9890 • 718-460-3634 • Fax: 516-364-9045 • www.dvirkaandbartilucci.com

June 11, 2013

John Reinhardt, Commissioner
Department of Water
Town of Hempstead
1995 Prospect Avenue
East Meadow, NY 11554

Re: Proposal for Engineering Services
VOC Treatment at Wells 7A, 8A and 13
Levittown Water District

Dear Mr. Reinhardt:

As requested, Dvirka and Bartilucci Consulting Engineers (D&B) is pleased to submit this proposal for engineering services associated with the design and construction of VOC treatment at Wells 7A, 8A and 13 in the Levittown Water District.

Recent routine water quality sampling performed by the Town has shown the presence of volatile organic compounds (VOCs) in these wells. The contaminants found in these wells are as follows:

Contaminant Name	Wells 7A & 8A	Well 13
Freon 113	X	✓
1,1 dichloroethene	✓	X
m+p xylene	✓	X
1,1 dichloroethane	✓	X

<u>Wells 7A and 8A</u>

Wells 7A and 8A are on the same site located on Bowling Lane. The contaminants detected in these wells are currently at low concentrations and can be effectively removed using granular activated carbon (GAC) filtration. However, the source of this contamination is not currently known, therefore, the potential maximum influent concentration is not known. During the design report investigation, an effort will be made to identify the source and potential maximum influent concentration. A decision will be made at that time whether to use a GAC filtration or packed tower aeration treatment system. In either case, the site is suitably sized to accommodate the treatment system.

The electric service, switchgear and MCC at this site have been recently upgraded. Modifications to this equipment will be limited to only that which is required for the new treatment facility. Additional work at this site will include modifications to the lime slurry storage and feed system. If GAC filtration is selected, the building will be designed for the treatment vessels to be partially underground resulting in a reduced roof height as compared to other Town owned GAC facilities. This will minimize the aesthetic impact on the neighborhood. If a packed tower aeration system is selected, the design will include architectural provisions to enclose the tower and for the building to blend into the neighborhood as much as possible.

The work at this site will be included a single bid document with three prime contracts as follows: General Construction, Plumbing Construction and Electrical Construction. The estimated construction cost for this project is $2,300,000 with construction beginning in 2014.

<u>Well 13</u>

Well 13 is located on a separate site on Entry Lane, less than one mile away from the Bowling Lane site. The contaminant detected in this well (Freon 113) cannot be removed with GAC filtration. Therefore a packed tower aeration system will be required at this site. The existing electrical system will be upgraded and modified to accommodate the new loads. The existing auxiliary engine and drive for the well pump will be removed and a new standby natural gas generator will be installed to power the entire facility. The generator will be installed in a separate walk-in enclosure. An automatic transfer switch will be provided.

It is our understanding that an enclosed tower will not be required at this site.

The work at this site will be included in a single bid document with three prime contracts as follows: General Construction, Plumbing Construction and Electrical Construction. The estimated construction cost for this project is $1,800,000 with construction beginning in 2013.

ENGINEERING PROPOSAL

I. SCOPE OF SERVICES

A. <u>Preliminary Design Report</u>

1. Meet with the Water Department to obtain necessary data and to discuss the project details.

2. Procure a radius search of known contamination sites surrounding the wells.

3. Request documentation from NYSDEC and/or USEPA for relevant contamination sites.

4. Evaluate treatment alternatives at each site.

5. Review capacity of existing well pumps under new pressure conditions.

6. Prepare a draft design report for review by the Town. A single report will be prepared addressing both sites.

7. Prepare a cost estimate for the recommended treatment system.

8. Meet with the Town to discuss their comments on the draft report.

9. Prepare a final design report incorporating the Town's comments and submit the report to NCDH for approval.

B. Detailed Design Services

1. Retain a third party company to mark out the underground utilities at each site.

2. Prepare a topographic survey of each site.

3. Solicit bids for soil borings and geotechnical reports at each site.

4. Prepare conceptual architectural plans and elevations for review by the Town.

5. Meet with the Town to review the conceptual architectural plans and elevations.

6. Prepare a separate set of detailed plans and specifications for each site for bidding purposes. Submit drafts for Town review.

7. Meet with Town to review comments on draft submittals.

8. Finalize contract documents.

9. Submit the necessary forms, drawings and specifications to the NCDH for approval.

C. Bidding and Construction Services

1. Provide twenty (20) copies of plans and specifications for each contract set for the Town's use in procuring bids.

2. Answer bidder questions during bid period.

3. Attend bid openings and make recommendations for the lowest qualified bidders.

4. Prepare twelve (12) sets of conformed contracts for the Town's use in contract execution.

5. Attend a preconstruction meeting with the Contractors and the Water Department. Prepare minutes of the meeting.

6. Review shop drawings for conformance with the project drawings and specifications.

7. Provide construction services consisting of part time inspection during critical periods of the work. (D&B estimates that the project will require 440 hours of part-time inspection.)

8. Attend progress meetings as the work progresses. Prepare minutes of the meetings. A total of eight (8) meetings are assumed.

9. Monitor Contractor's progress.

10. Review Contractor requests for information.

11. Issue supplementary details and instructions if required.

12. Review Contractor construction schedules.

13. Review Contractor requests for change orders.

14. Review Contractor schedule of values.

15. Review Contractors' monthly requests for payment and make recommendation for approval.

16. Make final inspection and recommendation for final acceptance.

17. Submit certification of completed work to NCDH.

18. Prepare punch list for each contract.

19. Review warranties, O&M manuals, manufacturer's certifications and as-built drawings submitted by contractors.

D. Start-Up Assistance

1. Meeting with NCDH upon completion of construction as required for approval to operate the facility.

2. Attend and chair a start-up meeting with the Town and Contractors.

3. Assist the Town during the start-up and testing of the new system.

II. FEES

The fees for the engineering services described in Section I – Scope of Services, will not exceed the following:

Preliminary Design Report	$23,000
Detailed Design Services	$205,000
Outside Services*	$17,000
Bidding and Construction Services	$188,000
Start-Up Assistance	$26,000
Total	$459,000

*Outside services include utility contamination search, mark out, soil borings and geotechnical report. These services will be billed to the Town at cost without markup.

The Town will be invoiced monthly based on the hourly billing rates of employees in accordance with the mutually agreed upon salary schedule.

If you require further information or have any questions, please feel free to call to me.

Very truly yours,

William D. Merklin, P.E.
Vice President

WDMt/kap
•PX6633\WDM050313JR(R01)

EXHIBIT C

TOWN OF HEMPSTEAD
DEPARTMENT OF WATER
LEVITTOWN WATER DISTRICT

Design Report
Packed Tower Aeration System
Wells 7A & 8A

August 2014
(Revised February 2016)

Prepared By:

D&B ENGINEERS AND ARCHITECTS, P.C.
KNOWN AS DVIRKA AND BARTILUCCI CONSULTING ENGINEERS

TOWN OF HEMPSTEAD

DEPARTMENT OF WATER

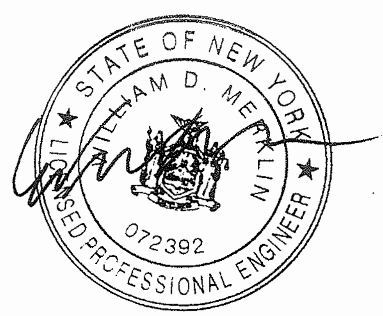
LEVITTOWN WATER DISTRICT

DESIGN REPORT
PACKED TOWER AERATION SYSTEM
WELLS 7A & 8A

PREPARED BY

D&B ENGINEERS AND ARCHITECTS, P.C.

WOODBURY, NEW YORK



AUGUST 2014

(REVISED FEBRUARY 2016)

•3402\KK04161402_Well 7A & 8A(R02)

TOWN OF HEMPSTEAD
DEPARTMENT OF WATER
LEVITTOWN WATER DISTRICT
DESIGN REPORT
PACKED TOWER AERATION SYSTEM
WELLS 7A & 8A

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1.0 INTRODUCTION

1.1 General

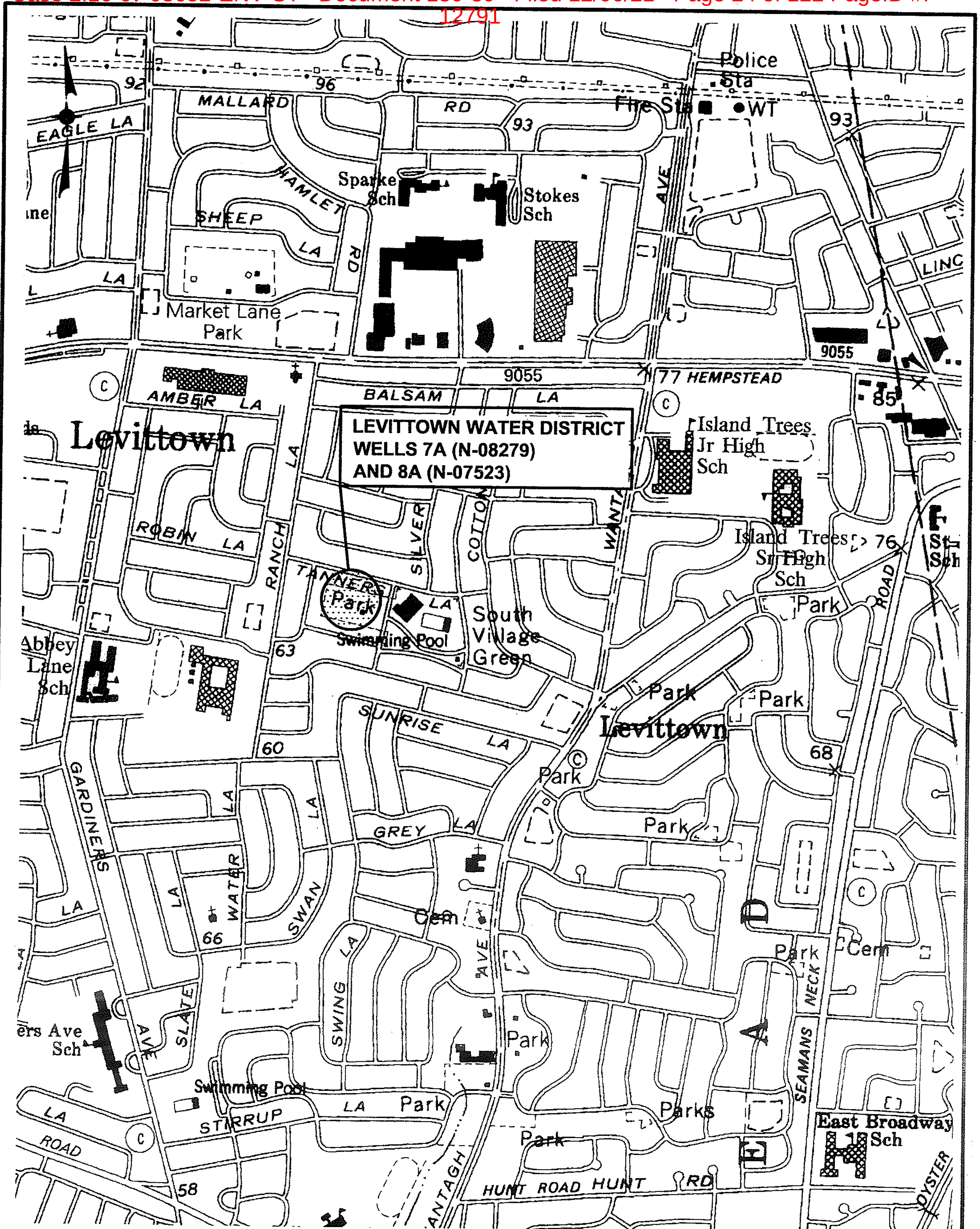
The Levittown Water District (LWD), which is operated by the Town of Hempstead Department of Water, serves a primarily residential area of approximately 3.9 square miles and approximately 50,000 residents. The Water District maintains 15 public water supply wells, nine of which are currently in service. The locations of the wells are indicated on **Figure 1-1.**

In 2013, the water in Wells 7A and 8A exhibited trace concentrations of volatile organic compounds (VOCs). Between the beginning of 2012 and the date of this report, the water has exhibited increasing levels of primarily three volatile compounds, 1,1 Dichloroethane (1,1 DCA) in Well 7A and 1,1,2-Trichloro-1,2,2-Triflouroethane (Freon 113) and Tetrachloroethene (PCE) in Well 8A. Samples collected on May 14, 2013 indicated that the concentrations of Freon 113 were approaching the maximum contaminant level (MCL) for these contaminants.

Since it is essential to maintain the use of Wells 7A and 8A in order to reliably meet the demand for water in the Levittown Water District, the Water District plans to construct a packed tower aeration system to remove 1,1 DCA from Well 7A as well as Freon 113 and PCE from Well 8A. The proposed system will be constructed to receive the raw water flow from the existing wells and will allow for chemical treatment (disinfection and pH adjustment) of the finished water prior to entering the distribution system.

1.2 Background Information

The facilities at the Well 7A and 8A site presently include two 1,200-gpm deep well turbine pumps with 100-horsepower electric motors on both Well 7A and 8A, sodium hypochlorite injection equipment for disinfection and lime injection equipment for pH adjustment. The equipment is housed within an aboveground well house. Physical data on Wells 7A and 8A are as follows:



F:\3402\FIGURE\3402-FIG1.dwg, 2/21/2014 9:24:01 AM, KSaul

DVIRKA AND BARTILUCCI CONSULTING ENGINEERS
A DIVISION OF D&B ENGINEERS AND ARCHITECTS, P.C.

TOWN OF HEMPSTEAD
DEPARTMENT OF WATER

N.T.S.

WELLS 7A AND 8A - LOCATION MAP

FIGURE 1

Well	7A	8A
NYSDEC No.	N-08279	N-07523
Well Depth (ft)	547	684
Well Pump Capacity (gpm)	1,200	1,200
Well Pump Motor Horsepower	100	100
Well Pump RPM	1,770	1,770
Well Construction Date	1969	1965

Regional groundwater flow in the vicinity of Wells 7A and 8A is towards the south.

2.0 EXISTING FACILITIES AND WATER QUALITY HISTORY

2.1 Existing Facilities

The primary working components of the Levittown Water District water supply system at this time are: nine wells located at six stations, two elevated storage tanks capable of storing a total of 2.5 million gallons and a strong distribution system with major 10-inch and 12-inch loops. The Levittown Water District has five interconnections with neighboring water systems including one with Hicksville Water District, three with Bethpage Water District and one with East Meadow Water District. Four wells and four booster pumps are equipped with standby generators and two wells are equipped with auxiliary engines and right angle drives.

The average daily pumpage for the district is approximately 4.85 million gallons per day (mgd) and the maximum day pumpage is approximately 11.11 mgd (7,715 gallons per minute).

The capacities of the nine wells in the system are indicated in **Table 2-1**. It is essential that all of the system wells be available in order to reliably meet demands such as maximum day, maximum hour, maximum day plus fire, a consecutive series of high demand days and average day demand during a power outage.

The water at Wells 7A and 8A is treated with lime to increase the pH for corrosion control. In addition, sodium hypochlorite is added for disinfection. Both chemicals are currently injected in the well discharge piping within the well station, prior to entering the distribution system.

2.2 Water Quality History at Wells 7A and 8A

2.2.1 Volatile Organic Compounds

Well 7A, which is 547 feet deep, and screened in the Magothy aquifer, has shown

Table 2-1

LEVITTOWN WATER DISTRICT WELLS
GENERAL INFORMATION

Well No.	Permit Capacity (gpm)	Actual Capacity (gpm)	Treatment*
1A	1,380	1,360	Packed Tower Aeration
2A	1,320	1,120	Packed Tower Aeration
5A	1,320	1,000	Packed Tower Aeration
6B	1,380	1,000	Packed Tower Aeration
7A	1,200	1,240	None
8A	1,200	1,100	None
12	1,200	1,000	None
13	1,200	1,200	None
14	1,200	370	None
Total		9,390	
With Largest Out		8,030	

*All wells receive lime and sodium hypochlorite as part of their treatment.

increasing levels of 1,1-Dichloroethane (1,1 DCA) in the past several months, as shown in **Table 2-2**. Well 8A, which is 684 feet deep, and also screened in the Magothy aquifer, has shown increasing levels of 1,1,2-Trichloro-1,2,2-Triflourothane (Freon 113) and Tetrachloroethene (PCE) in the past several months, as shown in Table 2. In May of 2013, the concentrations of Freon 113 neared the Maximum Contaminant Level (MCL) of 5.0 μg/l for this specific compound. In order for the District to continue to provide an adequate supply of water to the distribution system into the future, it is necessary to construct a treatment facility for removal of volatile organic compounds (VOCs) from this water source.

A radius search was performed to identify possible sources of the VOC contamination in Wells 7A and 8A within an approximate 2-mile radius of the wells. Based on the nature of the surrounding properties and information provided in the radius search, none of the surrounding properties within 2 miles represent possible sources of contamination for the LWD public water supply wells. However, the Northrop Grumman Systems Corporation (Grumman) site is located approximately 2 to 2.5 miles north-northeast of the LWD public water supply wells, as depicted on **Figure 2-1**. Based on a groundwater flow direction to the south-southeast, the Grumman site is located up gradient of the LWD wells. Thus the Grumman Superfund site was identified and considered as a possible source:

- Northrop Grumman Systems Corporation – ID# NYD002047967

According to various water quality reports obtained from the New York State Department of Conservation (NYSDEC), the Grumman site is divided into three operable units:

- Operable Unit 1 (OU-1) consists of the former manufacturing plant area;
- Operable Unit 2 (OU-2) consists of the groundwater contamination plume and is a joint operable unit for both the Grumman Site and a Naval Weapons Industrial Reserve Plant site; and
- Operable Unit 3 (OU-3) consists of the Former Grumman Settling Ponds, Grumman Access Road, some adjacent property and impacted groundwater which is not addressed by OU2.

Table 2-2
Levittown Water District Wells 7A and 8A Packed Tower Aeration System
VOC and THM Sampling Data Summary

	Chemical	MCL (µg/L)	1/5/2012	4/23/2012	5/3/2012	5/8/2012	5/15/2012	5/17/2012	5/22/2012	5/30/2012	6/7/2012	6/21/2012	6/20/2012	6/25/2012	7/3/2012	8/1/2012	9/6/2012
Well 7A	Chloroform	5	N/D	N/D	0.55	N/D	N/D	1	0.53	N/D	N/D	0.7	0.74	0.73	N/D	0.54	0.61
N-08279	1,1-Dichloroethane	5	N/D	0.92	1.02	N/D	N/D	0.9	N/D	N/D	N/D	N/D	N/D	1	N/D	N/D	N/D
	Total VOC	N/A	0	0.92	1.57	0	0	1.9	0.53	0	0	0.7	0.74	1.73	0	0.54	0.61
	Total THMs	80	N/D	N/D	0.55	N/D	N/D	1	0.53	N/D	N/D	0.7	0.74	0.73	N/D	0.54	0.61

	Chemical	MCL (µg/L)	10/3/2012	11/14/2012	12/10/2012	1/3/2013	2/1/2013	3/5/2013	4/8/2013	5/7/2013	6/3/2013	7/3/2013	7/29/2013	8/8/2013	8/13/2013	8/20/2013	8/27/2013
Well 7A	Chloroform	5	0.81	0.8	0.61	N/D	0.9	1.1	1.13	1.32	1.01	0.99	1.45	1.47	1.6	1.45	1.46
N-08279	1,1-Dichloroethane	5	0.57	0.8	N/D	N/D	0.8	1	0.93	1	0.66	0.83	0.8	0.76	0.91	0.59	0.58
	Total VOC	N/A	1.38	1.6	0.61	0	1.7	2.1	2.06	2.32	1.67	1.82	2.25	2.23	2.51	2.04	2.04
	Total THMs	80	0.81	0.8	0.61	N/D	0.9	1.1	1.13	1.32	1.01	0.99	1.45	1.47	1.6	1.45	1.46

	Chemical	MCL (µg/L)	9/5/2013	9/9/2013	9/19/2013	9/27/2013	9/30/2013	10/7/2013	10/17/2013	10/23/2013	10/31/2013	11/8/2013	11/14/2013	11/20/2013	11/25/2013	12/2/2013	12/12/2013
Well 7A	Chloroform	5	1.65	1.47	1.76	1.89	1.57	1.61	1.38	1.37	1.31	1.12	0.88	1.58	1.69	1.62	1.51
N-08279	1,1-Dichloroethane	5	N/D	0.98	N/D	N/D	0.74	0.59	0.9	0.8	0.91	0.95	0.51	0.98	1.13	1.09	1.05
	Total VOC	N/A	1.65	2.45	1.76	1.89	2.31	2.2	2.28	2.17	2.22	2.07	1.39	2.56	2.82	2.71	2.56
	Total THMs	80	1.65	1.47	1.76	1.89	1.57	1.61	1.38	1.37	1.31	1.12	0.88	1.58	1.69	1.62	1.51

	Chemical	MCL (µg/L)	12/16/2013	12/23/2013	12/30/2013	1/6/2014	1/13/2014	1/23/2014	1/27/2014	2/3/2014	2/10/2014	2/20/2014	2/24/2014	3/3/2014	3/10/2014	3/17/2014	3/28/2014
Well 7A	Chloroform	5	1.67	1.6	1.58	1.63	1.41	1.83	1.45	1.53	1.43	1.57	1.57	1.58	1.53	1.58	1.55
N-08279	1,1-Dichloroethane	5	1.13	1.09	1.18	1.18	0.93	1.22	0.85	0.92	0.95	1.03	1.02	1.04	0.93	1.07	0.96
	Total VOC	N/A	2.8	2.69	2.76	2.81	2.34	3.05	2.3	2.45	2.38	2.6	2.59	2.62	2.46	2.65	2.51
	Total THMs	80	1.67	1.6	1.58	1.63	1.41	1.83	1.45	1.53	1.43	1.57	1.57	1.58	1.53	1.58	1.55

	Chemical	MCL (µg/L)	4/3/2014	4/7/2014	4/14/2014	4/21/2014	4/28/2014	5/5/2014	5/13/2014	5/20/2014	5/27/2014	6/2/2014	6/9/2014	6/16/2014	6/24/2014	6/30/2014	7/7/2014
Well 7A	Chloroform	5	1.5	1.47	1.64	1.87	1.66	1.81	1.61	1.53	1.62	1.84	1.82	1.75	1.85	2.02	1.59
N-08279	1,1-Dichloroethane	5	0.94	0.97	1.04	1.2	0.99	1.11	0.92	1.01	1.04	1.06	1.11	1.1	1.1	1.29	1.15
	Total VOC	N/A	2.44	2.44	2.68	3.07	2.65	2.92	2.53	2.54	2.66	2.9	2.93	2.85	2.95	3.31	2.74
	Total THMs	80	1.5	1.47	1.64	1.87	1.66	1.81	1.61	1.53	1.62	1.84	1.82	1.75	1.85	2.02	1.59

	Chemical	MCL (µg/L)	7/14/2014	7/24/2014	7/29/2014	8/4/2014	8/11/2014	8/18/2014	8/27/2014	9/2/2014	9/8/2014	9/18/2014	9/22/2014	10/2/2014	10/6/2014	10/16/2014	10/20/2014
Well 7A	Chloroform	5	1.74	1.75	1.93	1.93	2.03	2.18	2.11	2.1	1.58	1.81	2.1	2.06	2.15	1.83	1.79
N-08279	1,1-Dichloroethane	5	1.18	1.25	1.23	1.14	1.19	1.28	1.22	1.21	0.98	1.24	1.34	1.23	1.23	1.08	1.11
	Total VOC	N/A	2.92	3	3.16	3.07	3.22	3.46	3.33	3.31	2.56	3.05	3.44	3.29	3.38	2.91	2.9
	Total THMs	80	1.74	1.75	1.93	1.93	2.03	2.18	2.11	2.1	1.58	1.81	2.1	2.06	2.15	1.83	1.79

	Chemical	MCL (µg/L)	10/27/2014	11/3/2013	11/10/2014	11/17/2014
Well 7A	Chloroform	5	1.92	1.57	1.91	1.15
N-08279	1,1-Dichloroethane	5	1.11	1.05	1.16	1
	Total VOC	N/A	3.03	2.62	3.07	2.15
	Total THMs	80	1.92	1.57	1.91	1.15

Maximum
2.18
1.34
3.46
2.18

Table 2-2
Levittown Water District Wells 7A and 8A Packed Tower Aeration System
VOC and THM Sampling Data Summary

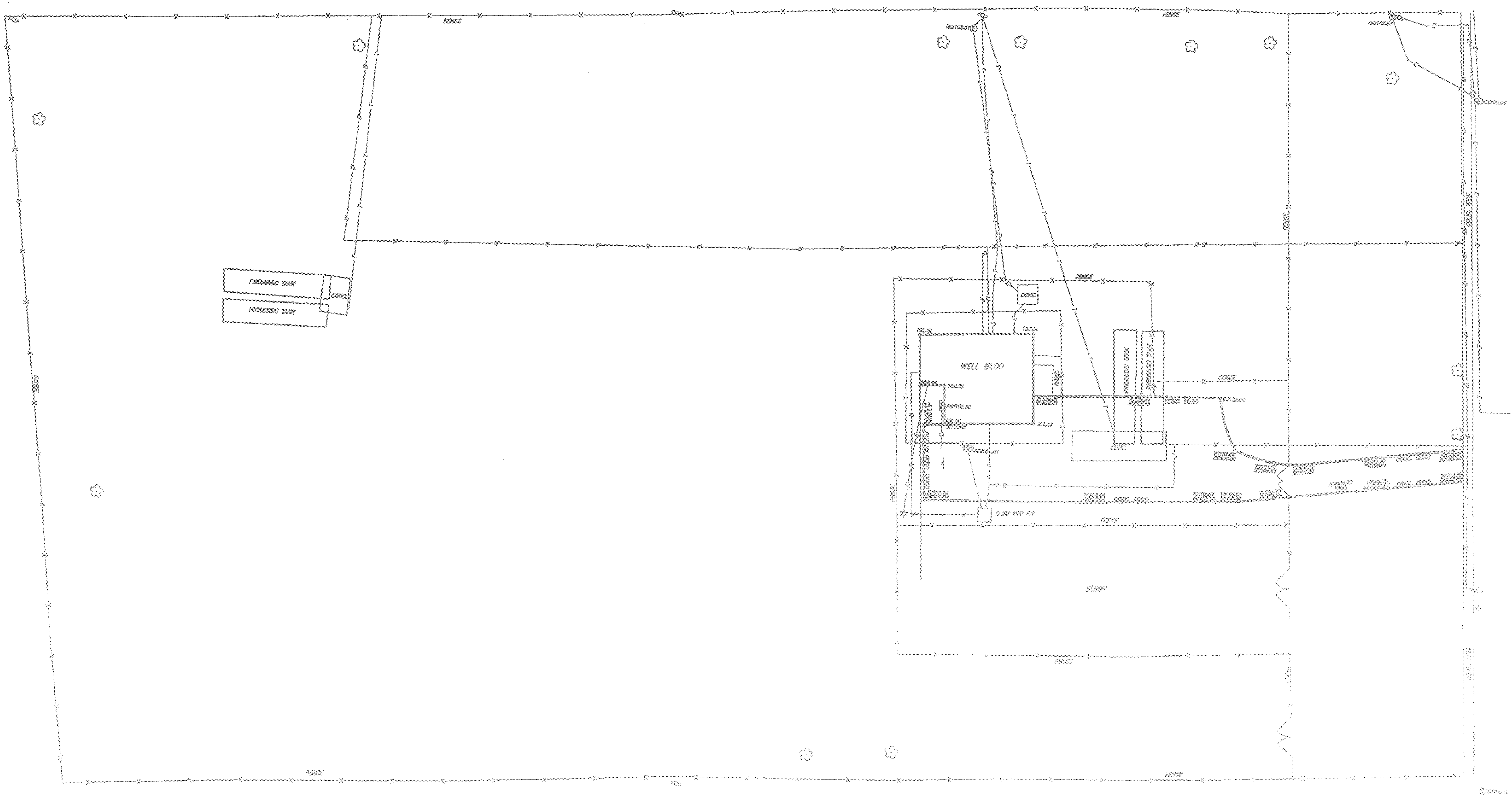
	Chemical	MCL (µg/L)	1/5/2012	4/23/2012	5/3/2012	5/8/2012	5/15/2012	5/17/2012	5/22/2012	5/30/2012	6/7/2012	6/13/2012	6/20/2012	6/25/2012	7/3/2012	7/20/2012	7/24/2012
Well 8A	Freon 113	5	N/D	1.11	1.01	1.03	1.01	1.9	1.12	1.05	N/D	1.21	1.26	1.24	1.17	N/D	N/D
N-07523	Tetrachloroethene	5	N/D	N/D	N/D	N/D	N/D	0.6	N/D	N/D	N/D	0.74	N/D	N/D	N/D	N/D	N/D
	Total VOC	N/A	0	1.11	1.01	1.03	1.01	2.5	1.12	1.05	0	1.95	1.26	1.24	1.17	0	0
	Total THMs	80	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D

	Chemical	MCL (µg/L)	8/1/2012	8/14/2012	8/21/2012	8/28/2012	9/6/2012	10/3/2012	11/14/2012	12/10/2012	1/3/2013	2/1/2013	3/5/2013	4/15/2013	5/7/2013	5/23/2013	5/29/2013
Well 8A	Freon 113	5	1.19	1.6	1.57	N/D	N/D	1.68	N/D	0.6	1.24	2.2	2.1	2.31	2.76	2.46	2.25
N-07523	Tetrachloroethene	5	N/D	N/D	0.59	0.63	N/D	1.44	N/D	N/D	N/D	0.55	N/D	N/D	0.63	N/D	N/D
	Total VOC	N/A	1.19	1.6	2.16	0.63	0	3.12	0	0.6	1.24	2.75	2.1	2.31	3.39	2.46	2.25
	Total THMs	80	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D

	Chemical	MCL (µg/L)	6/3/2013	6/12/2013	6/17/2013	7/3/2013	7//11/13	7/15/2013	7/23/2013	7/29/2013	8/8/2013	8/13/2013	8/20/2013	8/27/2013	9/5/2013	9/9/2013	9/19/2013
Well 8A	Freon 113	5	2.39	2.51	2.68	1.67	2.57	2.69	3.28	3.16	3	3.15	2.99	3.12	3.09	3.17	3.02
N-07523	Tetrachloroethene	5	N/D	N/D	N/D	N/D	0.51	0.5	N/D	0.64	0.62	0.69	0.52	N/D	N/D	0.63	N/D
	Total VOC	N/A	2.39	2.51	2.68	1.67	3.08	3.19	3.28	3.8	3.62	3.84	3.51	3.12	3.09	3.8	3.02
	Total THMs	80	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D

	Chemical	MCL (µg/L)	9/23/2013	9/30/2013	11/25/2013	3/17/2014	4/21/2014	6/12/2014
Well 8A	Freon 113	5	3.06	2.97	N/D	N/D	1.18	N/D
N-07523	Tetrachloroethene	5	N/D	0.56	N/D	N/D	N/D	N/D
	Total VOC	N/A	3.06	3.53	0	0	1.18	0
	Total THMs	80	N/D	N/D	N/D	N/D	N/D	N/D

Maximum
3.28
1.44
3.84
0



D&B ENGINEERS AND ARCHITECTS, P.C.
KNOWN AS DVIRKA AND BARTILUCCI CONSULTING ENGINEERS

TOWN OF HEMPSTEAD
LEVITTOWN WATER DISTRICT

EXISTING SITE PLAN

SCALE: 1"=40'

FIGURE 2

F:\3402\FIGURE\3402-FIG2.dwg, FIG-2, 3/7/2014 11:31:54 AM, kalesius

Currently, a large VOC groundwater plume extends from the Grumman Site and is actively migrating towards the south-southeast. This VOC plume consists of the OU-2 groundwater plume and the OU-3 groundwater plume, which are comingled at certain depths; however, the OU-2 groundwater plume is significantly larger in area. The off-site OU-2 plume is larger than 3,000 acres in size and ranges from approximately 150 to 750 feet deep, extending into the deep Magothy aquifer, including to the depths of the LWD public water supply well screen zones. In addition to various chlorinated VOCs, polychlorinated biphenyls (PCBs) and metals, the OU-2 groundwater plume includes the contaminants detected in Levittown Water District Wells 7A and 8A.

Based on the various groundwater reports obtained from the NYSDEC, LWD Wells 7A and 8A appear to be located along the southwestern edge of the OU-2 Grumman plume. As depicted in Appendix 1 there are few groundwater monitoring wells located in the immediate vicinity of the LWD wells. Other than the outpost monitoring wells discussed below, the closest groundwater monitoring wells (GM-34D and GM-34D2) are approximately 1-mile northeast of the LWD wells. These two wells are screened in the Magothy aquifer to a maximum depth of approximately 520 feet. The available data indicates consistent elevated VOC concentrations, with the most recent available data collected in June 2013 showing total VOC concentrations of up to 190 µg/l. In addition, the three VOCs detected in the LWD wells are present at the GM-34 location.

Due to the known VOC contamination migrating from the Grumman site, the NYSDEC required that a Public Water Supply Contingency Plan (PWCP) be developed as part of the selected remedy. As such, Arcadis prepared a PWCP dated July 22, 2003, which consisted of groundwater plume modeling and selecting locations for the installation of outpost monitoring wells (OPMWs). OPMWs were proposed to be installed up gradient of select public supply wells in order to provide an early warning of VOC plume migration towards the public supply wells. Trigger values, representing maximum VOC concentration limits, were established for each of the OPMWs and were developed to provide for approximately five years early warning prior to VOCs being detected in the down gradient supply well. An exceedance of a trigger value requires two additional confirmatory rounds of sampling. If confirmatory sampling indicates that

a trigger value has been reached, wellhead treatment or comparable alternate measures would be provided, with negotiations to be conducted with the water district.

Based on the 2003 groundwater flow and solute transport modeling, the PWCP determined that municipal supply well N5303 (LWD Well 13) was a potential receptor of the groundwater plume, but influent concentrations would remain below 0.5 µg/l over a 30 year period. Two OPMWs (BPOW-4-1 and BPOW-4-2) were installed approximately 700 to 800 feet up gradient of LWD Well 13, as a conservative measure. Note that OPMWs were not installed up gradient of LWD Wells 7A and 8A. According to field measurements obtained from the Arcadis 2010 Annual Report, outpost monitoring wells BPOW-4-1 and BPOW-4-2 are approximately 692 and 764 feet in depth, respectively. The locations of the installed OPMWs are depicted in **Appendix A**.

D&B reviewed available analytical data for OPMWs BPOW 4-1 and BPOW 4-2 provided by NYSDEC. Analytical data made available to D&B includes data from the first quarter of 2010 through the second quarter of 2013; however, several rounds of analytical data throughout this time period were not available. Based on a review of the analytical data, total VOC concentrations in OPMWs BPOW 4-1 and BPOW 4-2 have exhibited an increasing trend, with Freon-113 consistently detected in these wells, and more recently 1,1-DCE and TCE. Freon-113 has been detected in OPMWs BPOW 4-1 and BPOW 4-2 at least as early as February 2010 with concentrations of 0.87 µg/l and 0.44 µg/l, respectively.

According to available information, the total VOC trigger value for the OPMWs of 1.5 µg/l was first exceeded in BPOW 4-1 in March 2012. Two rounds of confirmatory sampling at BPOW 4-1 (completed in May 2012) indicate that total VOCs exceeded the trigger value of 1.5 µg/l, at concentrations of 2.1 µg/l and 1.9 µg/l, respectively. In addition, BPOW 4-2 first exceeded the trigger value in the fourth quarter of 2012. It is important to note that both BPOW 4-1 and BPOW 4-2 continue to exceed the trigger value, including during a recent sampling event during the second quarter of 2013, with total VOC concentrations of 4.0 µg/l and 1.8 µg/l, respectively.

Based on the EDR review and review of available documentation associated with the Grumman Site, it is likely that the VOCs detected in the LWD wells are attributable to the VOC plume migrating from the Grumman Site, specifically the OU-2 groundwater plume. Quarterly groundwater sampling data obtained from NYSDEC indicates that the Grumman plume contains all of the VOCs detected in the LWD wells, and is present at similar depths as the screen zones of the LWD wells. The VOC detections discussed above in OPMWs located immediately up gradient of the LWD wells indicate that groundwater in the vicinity of the LWD wells is impacted with Grumman-related VOCs. According to the PWCP, the trigger value exceedances detected at OPMW BPOW 4-1 indicate that the water district should be provided with remedial measures to protect the LWD wells.

2.2.2 Iron, Manganese and Nitrate (as N)

The concentration of iron in Well 7A is 0.12 mg/l and is below the MCL and should not interfere with the effective performance of the packed tower aeration system. The concentration of iron in Well 8A is below the detection limit of 0.05 mg/l and should not interfere with the effective performance of the packed tower aeration system. The concentration of manganese in Wells 7A and 8A is below the detection limit of 0.01 mg/l and should not interfere with the effective performance of the packed tower aeration system.

The nitrate concentration in Well 7A was 4.44 mg/l and the concentration in Well 8A was 2.88 during 2013, both of which are below the MCL of 10.0 mg/l and are not considered to be a threat to the continued use of these wells.

3.0 TREATABILITY EVALUATION

A packed tower aeration system will effectively treat the organic compounds detected in Levittown Water District's Wells 7A and 8A. Design criteria for the proposed packed tower aeration system are developed in this section.

3.1 Design Compounds

Contaminants observed in Wells 7A and 8A that have exhibited an increasing trend in recent months include 1,1-Dichloroethane (1,1 DCA), 1,1,2-Trichloro-1,2,2-Triflouroethane (Freon 113), and Tetrachloroethene (PCE). It is projected that these trends may continue and the concentrations of these particular contaminants may significantly exceed the MCL. Additionally, the plume from which these compounds originated contains up to 420 μg/l of Trichloroethylene (TCE) which, if the plume continues as it has been, may ultimately reach Wells 7A and 8A. Thus the design compounds for the treatment system have been determined to be 1,1-DCA, Freon 113, PCE and TCE.

Dilute solutions containing organic compounds, such as contaminated groundwater, behave according to Henry's Law, which states that at any interface between aqueous (liquid) and gaseous (air) phases, the concentration of a compound at the interface follows a linear relationship, as follows:

$$C_g = HC_L$$

where C_g = molar concentration of compound at gas phase interface

C_L = molar concentration of compound at liquid phase interface

H = Henry Constant (unitless)

Compounds with relatively high Henry Constants tend to transfer readily from liquid to gas phases and as a result, are generally well suited for treatment using packed tower aeration.

Henry Constants for the design compounds for the Well No. 7A and 8A treatment system, as determined by the USEPA are listed in **Table 3-1**.

Table 3-1

HENRY CONSTANTS FOR WELL 7A AND 8A DESIGN COMPOUNDS

Design Compounds	**Henry Constant @ 10° C (Unitless)**
Chloroform	3.67
1,1-Dichloroethane (1,1-DCA)	0.23
1,1,2-Trichloro-1,2,2-Triflouroethane (Freon 113)	16
Tetrachloroethene (PCE)	0.75
Trichloroethylene (TCE)	0.42

All of these compounds exhibit Henry Constants which are within the ability of packed tower aeration to effectively reduce the concentrations of these organic contaminants from the groundwater.

3.2 Required Organic Removal Efficiency

The packed tower aeration system proposed for Wells 7A and 8A will be designed to provide effluent concentrations of less than 20 percent of the New York State Department of Health (NYSDOH) drinking water standard for each design organic compound. This criterion suggests a maximum design effluent concentration of 1.0 µg/l for each of the design compounds. At no time will effluent organic concentrations exceed NYSDOH drinking water standards.

The design influent VOC concentrations will be determined by the maximum measured concentrations of each of the contaminants upstream of Wells 7A and 8A as provided by the NYSDEC for the Grumman OU-2 plume. The maximum concentrations in the plume at the approximate depth of the wells (520 ft.) are presented in **Table 3-2**.

Table 3-2

MAXIMUM CONCENTRATIONS DETECTED IN THE GRUMMAN OU-2 PLUME FOR WELL 7A AND 8A DESIGN COMPOUNDS

Design Compounds	Maximum Concentration Detected in Grumman OU-2 Plume (2012) (Influent Design Criteria) (μg/l)	Required Removal Efficiency (%)
Chloroform	4.2	76.19
1,1-Dichloroethane (1,1-DCA)	5.8	82.76
1,1,2-Trichloro-1,2,2-Triflouroethane (Freon 113)	8.6	88.37
Trichloroethylene (TCE)	420	99.76
Tetrachloroethene (PCE)	12	91.67

These concentrations far exceed the maximum influent concentrations reported in Well 7A and 8A. The removal efficiency required to provide an effluent concentration of 1.0 μg/l at these influent concentrations is presented in **Table 3-3**.

3.3 DAR-1 Analysis

An initial screening of the packed tower emissions source impacts was completed using the NYSDEC's DAR-1 modeling software. This modeling allows for the determination of long-term (annual) and short-term (1 hour) impacts of the tower emissions on surrounding areas. The model was used on the wells to determine if there would be any impacts from any of the tower's influent constituents. The parameters used in this model are shown in **Table 3-3** below. For our packed tower aeration system the only constituent that violated the Annual Guideline Concentration (AGC) set forth by the NYSDEC was Trichloroethylene (TCE).

Table 3-3

MODEL PARAMETERS FOR DAR-1 ANALYSIS OF THE PACKED TOWER AERATION SYSTEM

Design Parameters	Packed Tower Aeration System	Vapor-Phase GAC Off-Gas Treatment System Effluent
Water Flow Rate	2,400 GPM	2,400 GPM
Model Height Above Structure	0 ft	5 ft
Model Stack Height	25 ft	30 ft
Stack Outlet Diameter	63 in(1)	20 in(2)
Exit Temperature	52° F	52° F
Model Exit Velocity	0.01 ft/s(3)	85.8 ft/s
Model Exit Flow Rate	0.01 ACFM(3)	11,230 ACFM
Shortest Distance to Property Line	125 ft	125 ft
Building Width	40 ft	40 ft
Building Length	65 ft	65 ft
Direction Building Length is Facing	0°	0°
UTME	626110	626110
UTMN	4508693	4508693
UTM Zone	18	18

Notes: 1. An equivalent outlet diameter has been calculated to equate to the dimensions of the tower vent ring.
2. An equivalent outlet diameter has been calculated to equate to the dimensions of the off-gas treatment vent stack.
3. At the NCDH's request, exit velocity and flow rate are considered to be negligible due to the PTAS horizontal exhaust condition.

The model determined that TCE at its maximum design influent concentration of 420 μg/l would be present in the packed tower emissions in sufficient quantity to violate the AGC of 0.2 $\mu g/m^3$. An influent water TCE concentration of 420 μg/l produced a maximum of 7.31 $\mu g/m^3$ of air emissions at 128 feet from the tower when the ISCLT2 Model was utilized. The Short-term Guideline Concentration (SGC) of 40,000 $\mu g/m^3$ was not violated under any condition. The lowest concentration of TCE which will cause a violation of the AGC to occur is

11 μg/l. Additionally, at 420 μg/l of TCE, the tower would only be allowed to operate 230 hrs/yr before violating the AGC. If a vertical discharge arrangement is utilized, the tower will violate the AGC at an influent concentration of 15 μg/l which would equate to an operational period of 312 hrs/yr. Due to the fact that the design influent concentrations of TCE cause a violation of the AGC it is necessary for the District to install off-gas treatment at Wells 7A & 8A.

Because the District requires use of this station at all times, reducing the usage of the wells is not an option, nor was it found to be particularly effective at reducing the concentration of TCE. Therefore a method of treating the off-gas to below the NYSDEC DAR-1 limits must be utilized. The most common method of off-gas treatment utilizes vapor phase activated carbon to adsorb and remove the VOCs from the off-gas. These systems are capable of 95% removal of VOCs from the off-gas of the packed tower aeration system. When one of these systems was incorporated into the DAR-1 modeling by decreasing loading of VOCs to 5% of their design amounts and ducting the effluent from the vapor phase carbon system to a height of 30 feet using a vertical discharge arrangement, the maximum concentration of TCE observed by ISCLT2 falls to 0.087 $\mu g/m^3$ at 167 feet from the tower which is well below both the SGC and AGC limits. The maximum allowable influent concentration (assuming 95% removal by the off-gas system) was determined via DAR-1 and ISCLT2 to be 960 μg/l of TCE which resulted in an emissions concentration of 0.199 $\mu g/m^3$ at 167 feet from the tower when the ISCLT2 Model is utilized. Freon 113 is not readily treated by carbon adsorption but with a maximum projected influent concentration of 8.6 μg/, the resulting concentration in the off-gas will be 0.388 ppb, well below the AGC of 180,000 ppb. 1,1-DCA is not readily treated by carbon adsorption but with a maximum projected influent concentration of 5.8 μg/l the resulting concentration in the off-gas will be 0.262, well below the AGC of 0.63 ppb. Thus a packed tower aeration system with a vapor phase activated carbon adsorption system for off-gas treatment is an acceptable solution.

One alternative for off-gas treatment that needs to be considered is installation of a rotor concentrator thermal oxidation system. The rotor concentrator thermal oxidation system for the treatment of off-gas is not a feasible alternative for the following reasons:

- A waste stream will be produced and need to be contained and disposed of.

- Secondary emissions of the oxidization process include NOx, CO, and HCI in concentrations which would exceed the AGCs put forth in DAR-1.

Other alternatives to packed tower aeration treatment at Wells 7A & 8A that need to be considered are installation of a GAC adsorption treatment plant at the site and drilling of a new well elsewhere in the District. Implementing GAC adsorption treatment at Wells 7A & 8A for the removal of the VOCs is not a feasible alternative for the following reasons:

- Two of the influent contaminants, Freon 113 and 1,1 DCA, cannot be readily treated by GAC adsorption.
- The operating cost for replacing the GAC media will be significant due to the high design concentrations of TCE in the source water.

Installation of a new well at a different site within the District is also not a feasible alternative to packed tower aeration treatment for the following reasons:

- Any new wells would require the District to purchase additional property on which to site the wells which would amount to a larger capital cost than the proposed improvements to the existing site.
- Sections of the District are in the likely path of the plume and would thus be unsuitable as a new water source without treatment similar to that to be installed at Wells 7A & 8A.
- Presence of nitrates at some locations within the District where existing wells have been abandoned.

Considering the above, the installation of a packed tower aeration system is the preferred treatment alternative for Wells 7A & 8A.

4.0 PROPOSED TREATMENT SYSTEM

The packed tower aeration system will be designed for 2,400 gpm, which is the District's maximum pumping rate for these combined wells. The system will consist of two packed towers in series, a concrete clearwell below each tower, one centrifugal blower and two vertical turbine pumps per tower to deliver treated water from the first clearwell into the second tower and from the second tower into the distribution system. A granular activated carbon off-gas treatment system will treat the off-gas of each tower. The associated controls and electrical systems will be located in the new aeration building. The existing chemical treatment systems shall be maintained in the existing well building, and the packed tower system effluent piping will be routed past the well building for chemical injection.

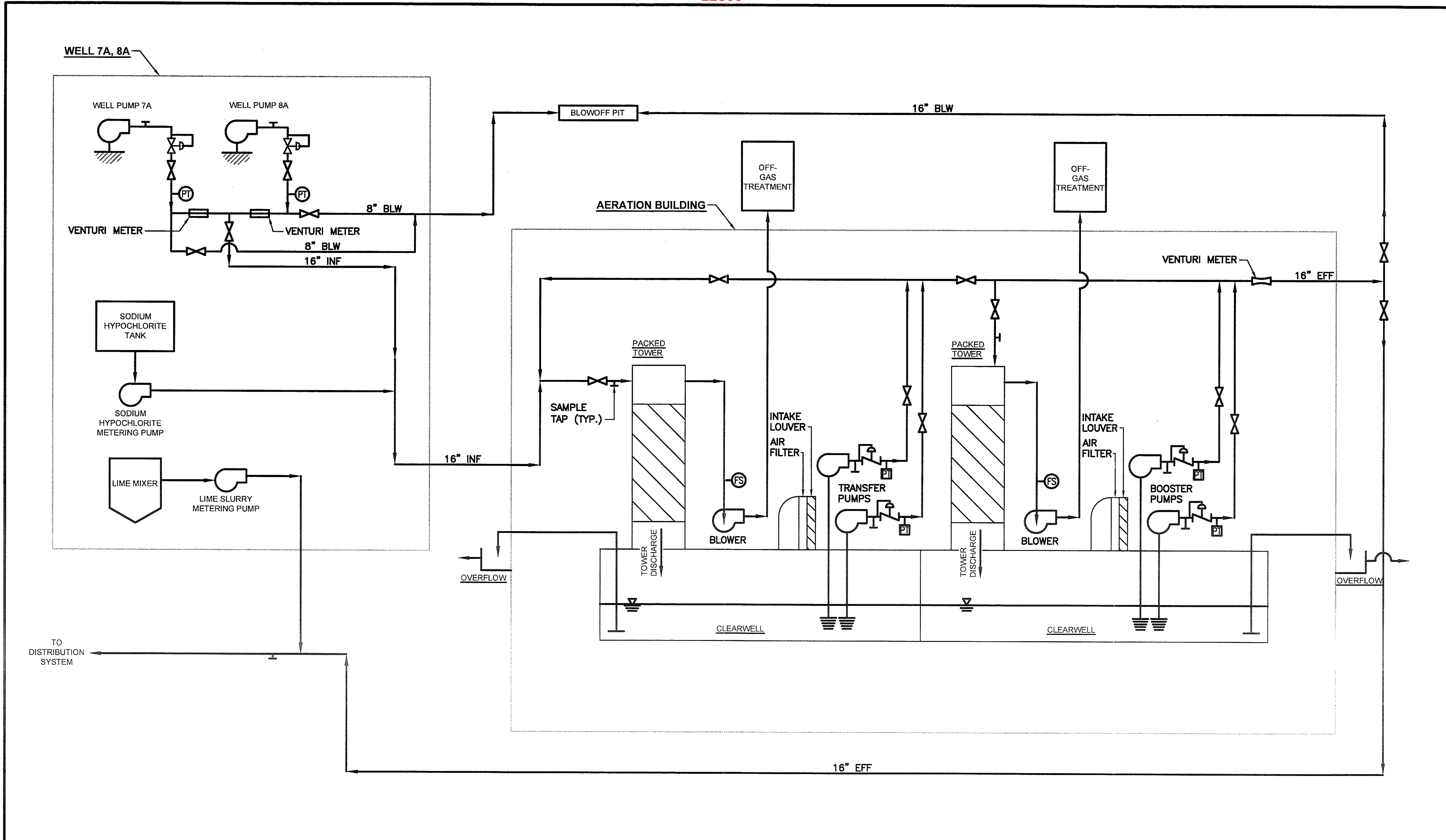
The proposed packed tower aeration system will be located in the middle of the Well 7A and 8A site next to the existing Well building. This portion of the site is currently unoccupied however it is not obscured from view. The packed tower aeration system and off-gas treatment will be housed in such a way as to mitigate the aesthetic appearance presented to the site's residential neighbors.

Figure 4-1 shows a schematic of the proposed piping for the packed tower aeration system in conjunction with the existing well station. **Figure 4-2** shows the proposed site plan.

4.1 Packed Tower Aeration System

The packed tower aeration system will be designed for a maximum flow of 2,400 gpm and influent concentrations of 420 μg/l of Trichloroethylene (TCE). The treatment system will be designed to reduce this compound to a concentration of 1.0 μg/l or less.

The existing well pumps will be replaced with new pumps designed for the reduced total dynamic head conditions that will result from installation of the aeration treatment system. The



F:\3402\FIGURE\3402-FIG3.dwg, FIG-3, 3/27/2014 10:50:06 AM, kalesius

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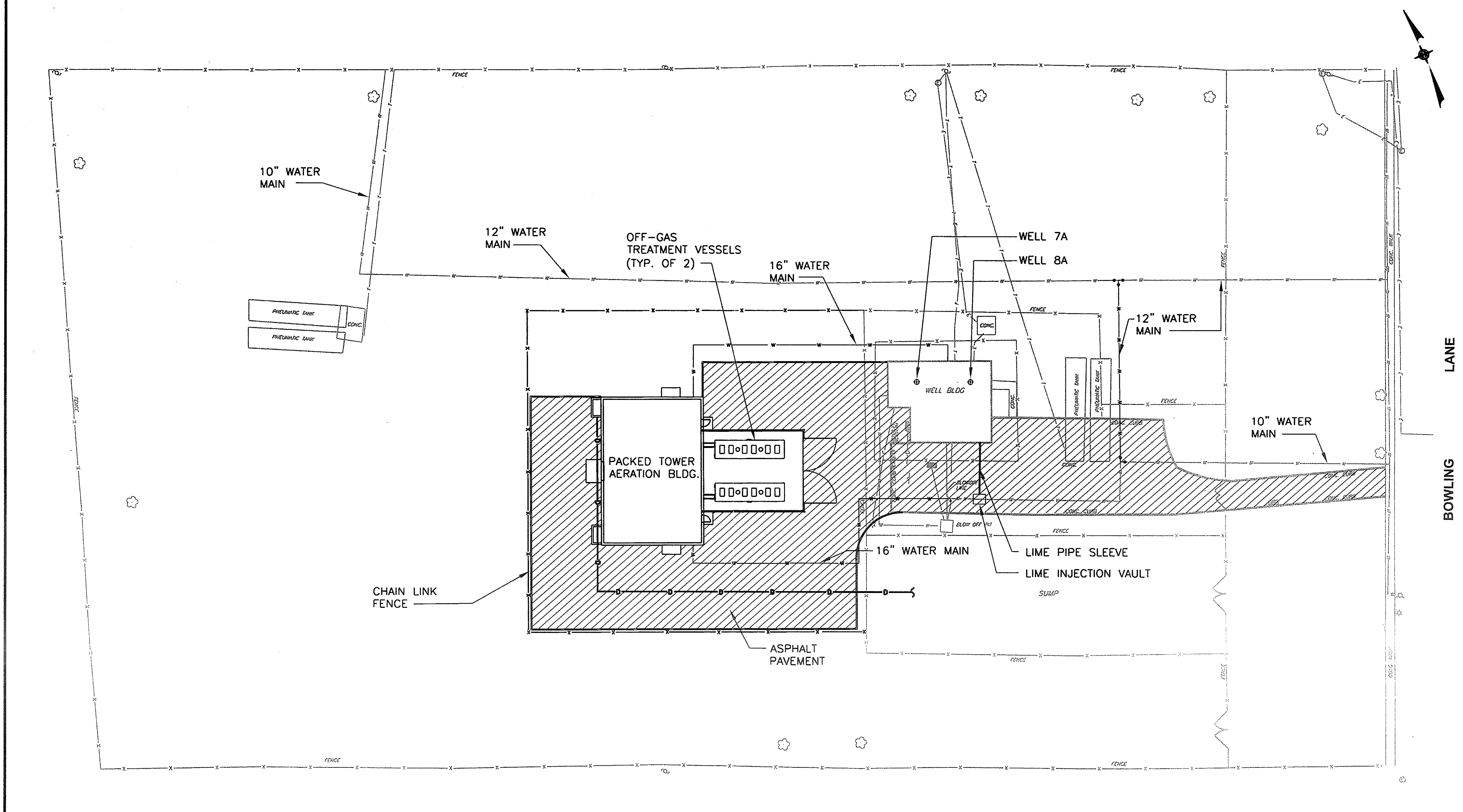
TOWN OF HEMPSTEAD
LEVITTOWN WATER DISTRICT

FACILITY SCHEMATIC

SCALE: 1"=40'

FIGURE 3



F:\3402\FIGURE\3402-FIG4.dwg, FIG-4, 8/19/2014 1:43:20 PM, JZegers

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TOWN OF HEMPSTEAD
LEVITTOWN WATER DISTRICT

PROPOSED SITE PLAN

SCALE: 1"=40'

FIGURE 4

modified well pumps will pump influent into the upper distribution tray of the first packed tower.

To treat the influent water to a level of 1 µg/l or less of TCE while keeping the overall tower height below 25 feet the system will require two towers in series. The overall tower height must be 25 feet or less in order to enclose the towers within a building which will mitigate the aesthetic appearance of the towers to the surrounding residents. The towers will each be 11 feet in diameter with a packing bed depth of 17 feet. The tower design TCE concentration has been selected to exceed projected future influent concentrations of any compound likely to be observed in Wells 7A and 8A based upon data from the Grumman OU-2 plume. The packing media will be 2.0-inch Jaeger Tripacks. The air flow rate will be 11,230 cfm creating a volumetric air to water ratio of 35:1. **Table 4-1** summarizes the packed tower aeration system design parameters.

The towers will be constructed of structural grade aluminum and will be designed to withstand all potential live, dead, wind and earthquake forces as required by the New York State Building Code. The internal tower components will be designed to achieve maximum air and water distribution throughout the tower. Three access manways will be provided along each tower shell, one immediately above the influent distribution tray, one at the top of the packing media, and one at the bottom of the packing media.

The towers will be mounted on top of the reinforced concrete clearwell with the base of each tower approximately 0.5 feet above grade elevation. Treated water will be discharged from the towers into the two separated clearwells below.

The towers will be housed inside of a structure designed to be aesthetically pleasing. The structure will be designed to include exterior aspects typical in residential construction and will hide the aluminum aeration towers from view. The building will be constructed with the finished floor as the clearwell top slab. The building housing the towers will have a maximum height of 35 feet to comply with Town of Hempstead Code.

Table 4-1

SUMMARY OF PACKED TOWER AERATION SYSTEM DESIGN PARAMETERS

Design Parameter	Value
Water Flow Rate	2,400 gpm
Air To Water Ratio	35:1
Air Flow Rate	11,230 cfm
Number of Towers	2
Tower Diameter	11 feet
Packed Bed Depth	17.0 feet
Overall Height	25.0 feet
Influent Concentration(1)	420 µg/l
Effluent Concentration(1)	1.0 µg/l

(1) Design volatile organic compound (VOC) is TCE.

4.2 Blower

The blowers will be centrifugal fans which will draw ambient air through an intake louver, air filter, acoustical silencer, upwards through the packed tower and out of the upper air vents of each packed tower. The blower will then discharge into ductwork which will send the tower off-gas through a vapor phase activated carbon treatment system and then to a discharge point approximately 30 feet above grade. The discharge ductwork will be housed within a brick chimney alongside the treatment building to make it more aesthetically pleasing. An airflow meter will be installed on the suction side ductwork of each blower. The blowers will each have a capacity of 11,230 cfm and will be equipped with 50-horsepower electric motors. The blower orientation allows for the use of only one blower per tower which can handle both the airflow required by the tower for treatment and the discharge to the off-gas treatment system. Additionally the blowers will be fitted with variable frequency drives (VFD) in order to allow for single well operation through the packed tower aeration system. Under single well operation the blowers would operate at a lower airspeed in order to conserve energy.

4.3 Transfer Pumps and Booster Pumps

The transfer pumps and booster pumps will be vertical turbine type with a capacity of 1,250 gpm each at 1,760 rpm. The two transfer pumps from the first clearwell will operate at approximately 50 feet of total dynamic head and the two booster pumps leaving the second clearwell will operate at approximately 230 feet of dynamic head to exceed the distribution system pressure. The two transfer pump motors will be 20 horsepower and the two booster pump motors will be 100 horsepower. The booster pump motors will reuse the existing 100 horsepower well pump motors if they are found to be suitable after inspection. The discharge pipe from the two booster pumps will be directed back through a new chemical injection vault outside the well building for lime injection. A backpressure control valve will be provided for each booster pump in the new aeration building and will control the booster pump flow into the second tower and distribution system respectively. The treatment system will discharge into the District's distribution system at two different points, consistent with the existing well pump discharge configuration.

4.4 Blow-off Piping

A 6-inch blow-off pipe with a manually operated buried gate valve will permit the discharge from the transfer pumps and booster pumps to be diverted to the existing well blow-off pit if it is necessary to waste packed tower effluent water rather than pump it to the distribution system. The blow-off pit drains into an on-site drainage sump which measures 150 ft by 50 ft with a maximum capacity of approximately 100,000 gallons and which allows the water to drain into the soil. The existing well blow-off system is currently connected to the existing blow-off pit and can accommodate wasted packed tower effluent generated during disinfection and sampling of the system. However, the existing well blow-off system is manually operated and will be replaced with an automatic well blow-off system which will serve as additional protection for the packed tower aeration system.

4.5 Well Pumps

The existing well pumps will be removed and replaced with new pumps designed to operate at a reduced total dynamic head. The new operating condition for each well pump will be 1,200 gpm at 135 feet of total dynamic head. The existing 100 horsepower motors will be removed and replaced with 50 horsepower motors to suit the new well pumps. The removed 100 horsepower motors will be inspected and if found suitable will be installed on the new booster pumps. The existing back pressure control valves in the well house will remain and operate under the new total dynamic head conditions of the modified system.

4.6 Off-Gas Treatment

An off-gas treatment system will be provided to remove any contaminants from the packed tower aeration system off-gas. The system will consist of two vapor phase activated carbon adsorption units, one for each tower, as well as all associated ductwork. The carbon adsorption units will each contain 16,000 lbs. of virgin vapor phase activated carbon to treat the VOCs present in the packed tower off-gas and will be located outside of the treatment building. The carbon adsorption units will be designed for operation at 100% humidity. The adsorption rate for the TCE under 100% humidity conditions will be 0.048 lbs of TCE per lb of carbon which at the design concentration of 420 µg/L will result in a change out of the carbon every 64 days when operating 24 hours per day at the maximum influent concentration of 420 ppb. Under 50% humidity conditions the adsorption rate for TCE would be 0.08 lbs of TCE per lb of carbon which at the design concentration of TCE would result in a change out of the carbon every 106 days. However, dehumidification to 50% is unfeasible due to the creation of a liquid waste stream contaminated with TCE and the other present VOCs condensed from the humid air. Additionally, the costs of heating the air for dehumidification will be excessive. The effluent air of the adsorption units will be ducted up to a height of 30 feet along the side of the treatment building before discharge. The effluent air ducts will be housed within chimneys for a more aesthetically pleasing treatment plant. Each of the vapor phase activated carbon units will have sample taps for sampling the carbon. The 75% bed depth sample tap will also be provided with a non-selective visual VOC breakthrough detector to assist in determining the breakthrough point.

4.7 Chemical Treatment

The existing lime tank and metering pump and sodium hypochlorite injection system are located inside of the existing well building. The current injection points for chemical treatment are located in the effluent line leaving the building. The sodium hypochlorite injection point will remain upstream of the packed tower aeration system and will have its dose adjusted to provide an appropriate residual concentration leaving the plant. However, the lime injection point must be relocated to a location downstream of the new packed tower to prevent accumulation of lime within the packed tower. To achieve this, the packed tower aeration system effluent pipe will be routed through a new injection vault to the south of the well building, and the lime piping will be rerouted to this new injection vault to provide for pH adjustment of the treatment system effluent. The lime piping will be housed within secondary containment piping between the well building and the new injection vault. A new water sampling line will be constructed downstream of the lime injection location on the distribution pipe to bring a sample stream to the existing analyzer equipment within the well building.

The existing chemical safety panel utilizes the well pump motor interlock, a limit switch on the well pump backpressure control valve, and a pressure switch on the well pump discharge pipe as the three safeties. The chlorine injection safeties will continue to operate with the current setup however, the lime injection safeties must be modified to operate in conjunction with the new booster pumps instead of the well pumps.

A new flow switch will be installed on each of the treated water pipes where the treated water leaves the aeration building, and limit switches will be installed on the new backpressure control valves in the aeration building. A new chemical safety panel will be installed in the well house to use these safeties as well as an electrical interlock with the new booster pump motor starters to permit lime metering pump operation.

4.8 Aeration Building

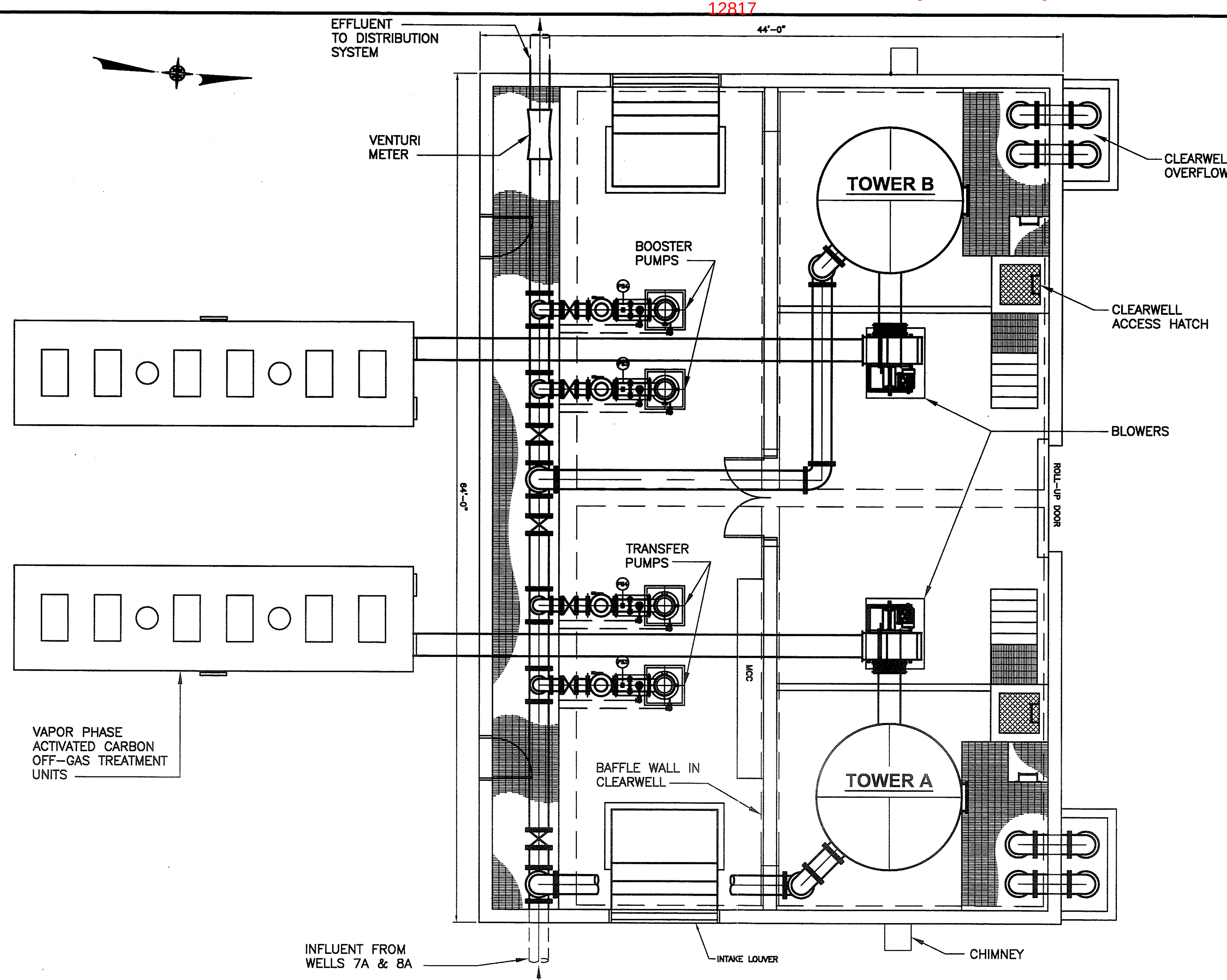
Figure 5 shows a floor plan of the proposed aeration building. The building will be architecturally designed to be aesthetically pleasing and will be constructed on top of a reinforced concrete clearwell. The packed towers will be mounted on top of the clearwells inside of the building. The clearwells will be constructed with baffle walls to eliminate dead zones. The packed towers will be completely enclosed within the packed tower aeration building in a lofted section to allow for access to the upper hatches on each tower. The building floor will be 0.5 feet above the existing grade elevation and the building will contain the transfer pumps, booster pumps, blowers, motor control center, packed tower control panel, packed towers, and appurtenances. The aeration building will be classified as a Utility and Miscellaneous Group U building according to the Building Code of New York State.

Hatches will be provided in the roof of the building to facilitate removal of the vertical turbine transfer and booster pumps, and two access hatches will be installed on the clearwell top slab to permit access to each clearwell. The aeration building will have one rollup door to allow removal of the blowers and control equipment and two mandoors for daily operations access.

Since the clearwells are located below grade, the overflow for each clearwell must exit through the top slab of the clearwell and terminate in a gooseneck at least 1 foot above grade. This sets the clearwell overflow elevation at 3'-0" above the finished floor. In order to prevent the packed tower building from flooding due to a potential clearwell overflow all equipment penetrations in the clearwell and the clearwell access hatches must be extended 3'-6" above the finished floor of the building.

4.9 Site Plan

Figure 4-3 shows the proposed site plan. The packed tower and aeration building serving Wells 7A and 8A will be located to the west of the existing well building in the middle of the site. New below-grade piping will be constructed to direct raw water into the packed tower



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TOWN OF HEMPSTEAD
LEVITTOWN WATER DISTRICT

AERATION BUILDING PLAN

SCALE: 1/8"=1'-0"

FIGURE 5

F:\3402\FIGURE\3402-FIG5.dwg, FIG-5, 3/27/2014 10:49:12 AM, kalesius

aeration system. New below-grade piping will direct packed tower effluent into a vault adjacent to the well building for pH adjustment, and into the distribution system. A new below-grade blow-off pipe will convey wasted water from the packed towers into the existing blow-off pit. Clearwell overflow will be routed into the existing blow-off pit and then on to the drainage sump by means of new gravity drainage pipe. Additionally all asphalt pavement on the site will be replaced.

4.10 Sampling Taps

An existing sampling tap on the Well No. 7A and 8A discharge piping will permit the sampling of raw well effluent prior to treatment, a new sampling tap will be installed on the influent piping of each tower and a new sampling tap will be provided on the base of each tower shell to allow a treated water sample to be collected. A new sampling tap on each transfer pump and booster pump discharge piping will permit collection of a water sample from each of the clearwells. A new sample tap will be installed downstream of the lime injection to allow collection of treated water prior to entering the distribution system.

4.11 Control System

The operation of the existing well pumps and the new blowers will be coordinated for proper operation of the packed tower aeration system. There will be four different modes of operation of the packed tower aeration system. These modes are designed around providing water immediately upon a need for water in the system. To this end the system will always terminate with the second clearwell full. The four modes that will be available will be SCADA initiated two well flow, SCADA initiated one well flow, locally initiated two-well flow, and locally initiated one-well flow.

The operating sequence under SCADA initiated two well flow will be to start the Booster Pumps 1 and 2 upon a call for water. After the lime metering pump flow safeties (from a pressure transducer on each booster pump and a venturi meter downstream of the booster pumps) are satisfied, the lime metering pump will begin to operate. Once the water level in Clearwell 2

falls below a setpoint a call to run for Transfer Pumps 1 and 2 will be triggered. Upon this trigger Blower 2 will begin to operate in 2 pump mode via a variable frequency drive (VFD). After confirmation that the blower is operating, the transfer pumps will be started. Failure of the blower to operate will prevent operation of the transfer pumps. Three separate safety devices (an electrical motor starter interlock, amperage meter and a pressure sensor) must detect blower operation in 2 pump mode before the transfer pumps will be permitted to start. Once the water level in Clearwell 1 falls below a setpoint a call to run for Well Pumps 7A and 8A will be triggered. Upon this trigger Blower 1 begins to operate in 2 pump mode via VFD. After confirmation that the blower is operating, the well pumps will be started. Failure of the blower to operate will prevent operation of the well pumps. Three separate safety devices (an electrical motor starter interlock, amperage meter and a pressure sensor) must detect blower operation in 2 pump mode before the well pumps will be permitted to start. The well pumps will initially run to blowoff before being diverted to Packed Tower 1 by automatically actuating valves. After the sodium hypochlorite metering pump flow safeties (a pressure transducer on each well pump and a venturi meter downstream of each well pump) are satisfied, the sodium hypochlorite metering pump will begin to operate.

The operating sequence under SCADA initiated one well flow will be to start one of the booster pumps (either Booster Pump 1 or 2 will operate based on a manual selector switch set by the Town) upon a call for water. After the lime metering pump flow safeties (from a pressure transducer on the booster pump and a venturi meter downstream of the booster pump) are satisfied, the lime metering pump will begin to operate. Once the water level in Clearwell 2 falls below a setpoint a call to run for the transfer pump will be triggered. Upon this trigger Blower 2 will begin to operate in 1 pump mode via the VFD. After confirmation that the blower is operating, one of the transfer pumps (either Transfer Pump 1 or 2 will operate based on a manual selector switch set by the Town) will be started. Failure of the blower to operate will prevent operation of the transfer pump. Three separate safety devices (an electrical motor starter interlock, amperage meter and a pressure sensor) must detect blower operation in 1 pump mode before the transfer pump will be permitted to start. Once the water level in Clearwell 1 falls below a setpoint a call to run for the well pump will be triggered. Upon this trigger Blower 1 will begin to operate in 1 pump mode via the VFD. After confirmation that the blower is

operating, the well pump (either Well Pump 7A or 8A will operate based on a manual selector switch set by the Town) will be started. Failure of the blower to operate will prevent operation of the well pump. Three separate safety devices (an electrical motor starter interlock, amperage meter and a pressure sensor) must detect blower operation in 1 pump mode before the well pump will be permitted to start. The well pump will initially run to blowoff before being diverted to Packed Tower 1 by automatically actuating valves. After the sodium hypochlorite metering pump flow safeties (a pressure transducer on the well pump and a venturi meter downstream of the well pump) are satisfied, the sodium hypochlorite metering pump will begin to operate.

Locally initiated two well flow mode and locally initiated one well flow mode will operate identically to their SCADA initiated counterparts with the exception of the call for water which will be initiated from a local pressure switch in the distribution system. Local control will only operate in the absence of SCADA control.

Operation of the transfer pumps and well pumps will be controlled by the water level in the clearwells. A low level float switch in Clearwell 2 will start the transfer pumps and a high level float switch in Clearwell 2 will stop the transfer pumps. This ensures that there will always be water available for the booster pumps to send to the distribution system immediately upon a call for water. A low level float switch in Clearwell 1 will start the well pumps and a high level float switch in Clearwell 1 will stop the well pumps. This ensures that there will always be water available for the transfer pumps to send to Packed Tower 2 immediately upon a transfer pump call to run. As a redundancy, the control system will also incorporate an electronic pressure transducer in each clearwell to detect setpoints for a low level condition and high level condition, to control cycling of the transfer pumps and well pumps. The control system will feature selector switches which will allow control of the transfer pumps and well pumps from either the electronic pressure transducer or the float switches.

An emergency high-high level float switch in each clearwell will trigger a high level alarm and shut down the transfer pumps, well pumps and the blower for each respective clearwell to prevent a clearwell overflow condition. An emergency low-low level float switch in each clearwell will trigger a low level alarm and shut down the booster pumps and transfer

pumps for each respective clearwell to prevent a water level below the level required for proper pump operation. Manual reset will be required for either high level alarms or low level alarms before returning to normal operating mode.

5.0 INFRASTRUCTURE SECURITY

In accordance with Ten State Standards, Recommended Standards for Water Works "Policy Statement on Infrastructure Security for Public Water Supplies," existing security features of the facility are reviewed and improvements to reduce vulnerability to intentional acts of vandalism, sabotage, and terrorism are evaluated for inclusion in the project.

The Well 7A and 8A property is protected from unauthorized entry by a continuous 6-foot chain link fence and gates that are maintained locked throughout the day. To monitor the buildings within the unmanned facility, the Town utilizes a Supervisory Control and Data Acquisition (SCADA) system to provide access control and to monitor for unauthorized entry into each building. Access control is granted for each authorized plant operator through the use of a magnetic key issued to each individual that is uniquely coded to identify the individual and their respective access permissions. Authorization to enter the site disarms the alarm monitoring system at the site. The alarm system is activated each time an operator leaves the site. The alarm system serves to prevent and alert the Town of unauthorized entry into a building through the use of door switches within each building. All critical equipment components of each treatment process, including water treatment chemical storage is maintained within buildings that are integrated into the access control and alarm system. The proposed packed tower aeration building on site will be integrated into the Town's existing access control and alarm system through SCADA. Where glass windows exist, the openings are obstructed with masonry block to discourage unauthorized entry. Site lighting is automatically illuminated each night to discourage unauthorized entry and aid in the detection of intruders. The facility is equipped with signage to encourage the public to report any suspicious activity in the area of the site.

The Town of Hempstead has standardized on certain sizes of well pump motors, chemical feed pumps and instrumentation devices to allow for interchangeability of equipment should critical station components fail or become damaged. This program allows for key system components to be maintained in storage, preventing procurement lead times associated with the purchase of major components. For packed tower systems the Town maintains spare blower

belts and air filters at the site to maintain an inventory of replacement parts and reduce the possibility of station downtime in the event that equipment is damaged or expended.

At this time, the existing security and access prevention measures at the Well 7A and 8A facility are considered to be adequate to mitigate the threat of illegal tampering with the water supply system.

6.0 COST ESTIMATE

The purpose of this cost estimate is to provide the Town with a budgetary value for funding the construction of the proposed packed tower aeration system. The estimate is based on the conceptual design as presented in this report.

Costs are based on manufacturer quotes for major equipment items and on other similar projects which have been recently completed. All costs include a 20-percent estimating contingency. Engineering and administrative fees are not included in the estimate. A breakdown of the cost estimate, as well as an operation and maintenance cost estimate can be found in Appendix C.

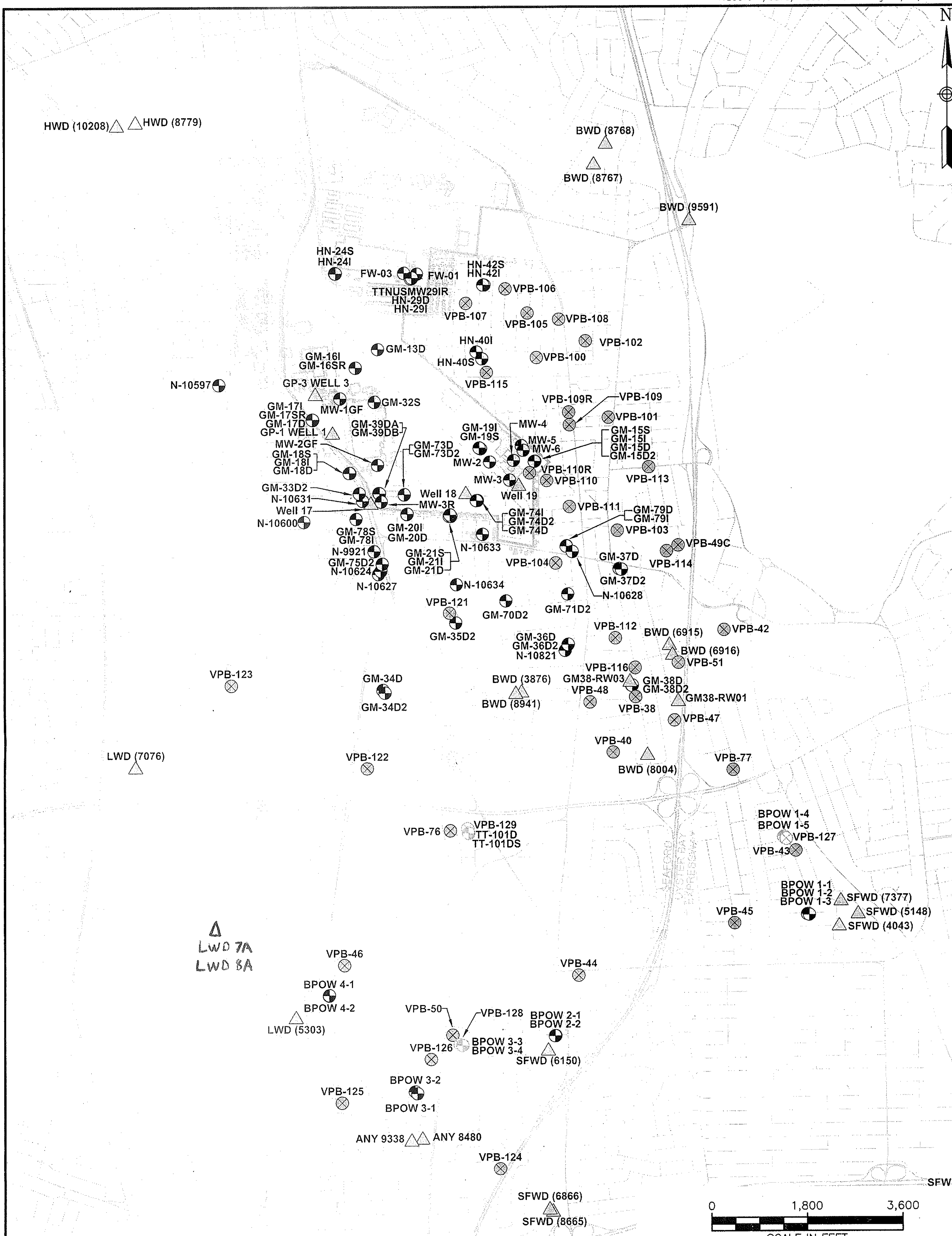
The estimated cost, assuming construction begins in 2014, is $3,870,000.

Evaluations of the project budget represent the Engineer's best judgment as a design professional familiar with the construction industry. It is recognized, however, that neither the Engineer nor the Owner has control over the cost of labor, materials or equipment, over the Contractor's methods of determining bid prices, or over competitive bidding, market or negotiating conditions. Accordingly, the Engineer cannot and does not warrant or represent that bids or negotiated prices will not vary from the Owner's project budget or from any estimate of the construction cost or evaluation prepared or agreed to by the Engineer.

APPENDIX A

GROUNDWATER SAMPLING WELL LOCATIONS

112G01041/0275/112G01041GM02.dwg 01/06/11 MKB



TETRA TECH NUS, INC.

LEGEND

- MONITORING WELL LOCATION
- PROPOSED MONITORING WELL LOCATION
- VERTICAL PROFILE BORING
- PROPOSED VERTICAL PROFILE BORING
- WATER SUPPLY WELL
- 1997 NORTHROP-GRUMMAN BETHPAGE BOUNDARY
- 1997 NWIRP BETHPAGE BOUNDARY
- BUILDING
- HIGHWAY
- MAJOR LOCAL ROAD
- MINOR LOCAL ROAD

OPERABLE UNIT 2 (SITE 1)
SITE MAP
NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
BETHPAGE, NEW YORK

FILE	SCALE
112G01041GM02	AS NOTED

FIGURE NUMBER	REV	DATE
FIGURE OU2TT–G1	0	01/07/11

APPENDIX B

DAR-1 RESULTS SUMMARY

Town of Hempstead Department of Water

Levittown Water District

Evaluation of Wells 7A & 8A

DAR-1 Analysis of Packed Tower Aeration System

Table 1

DESIGN PARAMETERS FOR WELLS 7A & 8A

PACKED TOWER AERATION SYSTEM

Design Parameters		
Well Number	7A	8A
NYSDEC Number	N-08279	N-07523
Air Flow Rate	5,615 CFM	5,615 CFM
Water Flow Rate	1,200 GPM	1,200 GPM
Air/Water Ratio	35:1	35:1
Tower Diameter	11.5 ft	11.5 ft
Liquid Loading Rate	23.1 GPM/SF	23.1 GPM/SF
Packed Bed Depth	17 ft	17 ft
Model Height Above Structure	0 ft	0 ft
Model Stack Height	25 ft	25 ft
Stack Outlet Diameter	63 in(1)	63 in(1)
Exit Temperature	52° F	52° F
Model Exit Velocity	0.01 ft/s(2)	0.01 ft/s(2)
Model Exit Flow Rate	0.01 ACFM(2)	0.01 ACFM(2)
Shortest Distance to Property Line	125 ft	125 ft
Building Width	40 ft	40 ft
Building Length	65 ft	65 ft
Direction Building Length is Facing	0°	0°
UTME	626110	626110
UTMN	4508693	4508693
UTM Zone	18	18

Notes: 1. An equivalent outlet diameter has been calculated to equate to the dimensions of the tower vent ring.
2. At the NCDH's request, exit velocity and flow rate are considered to be negligible due to the PTAS horizontal exhaust condition.

Table 2

3-Year Observed Maximum

Design Compounds	**CAS #**	**Observed Max Influent (µg/l)**	**Maximum Concentration (µg/m³)**	**AGC (µg/m³)**	**SGC (µg/m³)**
Chloroform	67-66-3	1.09	0.049	14.7	150
1,1-Dichloroethane	75-34-3	0.67	0.030	0.63	N/A
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	1.64	0.074	180,000	960,000
Trichloroethene	79-01-6	N/D	N/D	0.2	14,000
Tetrachloroethene	127-18-4	0.72	0.033	4	300

Table 3

Design Influent

Design Compounds	**CAS #**	**Design Influent (µg/l)**	**Maximum Concentration (µg/m³)**	**AGC (µg/m³)**	**SGC (µg/m³)**
Chloroform	67-66-3	4.2	0.190	14.7	150
1,1-Dichloroethane	75-34-3	5.8	0.262	0.63	N/A
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	8.6	0.388	180,000	960,000
Trichloroethene	79-01-6	420	**7.31 @ 128 ft.**	0.2	14,000
Tetrachloroethene	127-18-4	12	0.542	4	300

Table 4

Maximum Allowable Influent

Design Compounds	CAS #	Max Allowable Influent (µg/l)	Maximum Concentration (µg/m³)	AGC (µg/m³)	SGC (µg/m³)
Chloroform	67-66-3	320	14.48	14.7	150
1,1-Dichloroethane	75-34-3	13.5	0.610	0.63	N/A
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	420,000	18,965.488	180,000	960,000
Trichloroethene	79-01-6	11	0.192 @ 128 ft.	0.2	14,000
Tetrachloroethene	127-18-4	85	3.837	4	300

Table 5

DESIGN PARAMETERS FOR WELLS 7A & 8A

PACKED TOWER AERATION SYSTEM W/ VERTICAL DISCHARGE

Design Parameters		
Well Number	7A	8A
Air Flow Rate	5,615 CFM	5,615 CFM
Water Flow Rate	1,200 GPM	1,200 GPM
Model Height Above Structure	1 ft	1 ft
Model Stack Height	25 ft	25 ft
Stack Outlet Diameter	63 in(1)	63 in(1)
Exit Temperature	52° F	52° F
Model Exit Velocity	4.32 ft/s(2)	4.32 ft/s(2)
Model Exit Flow Rate	5,615 ACFM(2)	5,615 ACFM(2)
Shortest Distance to Property Line	125 ft	125 ft
Building Width	40 ft	40 ft
Building Length	65 ft	65 ft
Direction Building Length is Facing	0°	0°
UTME	626110	626110
UTMN	4508693	4508693
UTM Zone	18	18

Table 6

Maximum Allowable Influent w/ Vertical Discharge

Design Compounds	**CAS #**	**Max Allowable Influent (μg/l)**	**Maximum Concentration (μg/m³)**	**AGC (μg/m³)**	**SGC (μg/m³)**
Chloroform	67-66-3	320	14.48	14.7	150
1,1-Dichloroethane	75-34-3	13.5	0.610	0.63	N/A
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	420,000	18,965.488	180,000	960,000
Trichloroethene	79-01-6	15	0.196 @ 125 ft.	0.2	14,000
Tetrachloroethene	127-18-4	85	3.837	4	300

Table 7

DESIGN PARAMETERS FOR WELLS 7A & 8A

PACKED TOWER AERATION SYSTEM W/ OFFGAS

Design Parameters		
Well Number	7A	8A
Air Flow Rate	5,615 CFM	5,615 CFM
Water Flow Rate	1,200 GPM	1,200 GPM
Model Height Above Structure	5 ft	5 ft
Model Stack Height	30 ft	30 ft
Stack Outlet Diameter	63 in(1)	63 in(1)
Exit Temperature	52° F	52° F
Model Exit Velocity	42.9 ft/s(2)	42.9 ft/s(2)
Model Exit Flow Rate	5,615 ACFM(2)	5,615 ACFM(2)
Shortest Distance to Property Line	125 ft	125 ft
Building Width	40 ft	40 ft
Building Length	65 ft	65 ft
Direction Building Length is Facing	0°	0°
UTME	626110	626110
UTMN	4508693	4508693
UTM Zone	18	18

Table 8

Maximum Allowable Influent w/ Offgas

Design Compounds	**CAS #**	**Max Allowable Influent (µg/l)**	**Maximum Concentration (µg/m³)**	**AGC (µg/m³)**	**SGC (µg/m³)**
Chloroform	67-66-3	490	14.68	14.7	150
1,1-Dichloroethane	75-34-3	21	0.629	0.63	N/A
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	420,000	18,965.488	180,000	960,000
Trichloroethene	79-01-6	48	0.199 @ 167 ft.	0.2	14,000
Tetrachloroethene	127-18-4	130	3.895	4	300

APPENDIX C

COST ESTIMATE BREAKDOWN

TOWN OF HEMPSTEAD
LEVITTOWN WATER DISTRICT
PACKED TOWER AERATION SYSTEM
AT WELL 7A AND 8A
DESIGN REPORT COST ESTIMATE

DESCRIPTION		ESTIMATED COST	GC	PC	EC
DIVISION 1 - ADMINISTRATIVE/INSURANCE:					
Insurance/Bonds	$	20,000	6,667	6,667	6,667
Admin/Shop Dwgs	$	15,000	5,000	5,000	5,000
Testing/Startup	$	10,000	3,333	3,333	3,333
DIVISION 2 - SITE WORK:					
Asphalt Pavement	$	60,000	60,000	-	-
Fencing	$	25,000	25,000	-	-
Grass Restoration	$	5,000	5,000	-	-
Excavation/backfilling	$	100,000	100,000	-	-
Drainage Piping	$	25,000	25,000	-	-
Demolition/Removals	$	25,000	25,000	-	-
DIVISION 3 - CONCRETE:					
Clearwell Slabs	$	200,000	200,000	-	-
Clearwell Walls	$	250,000	250,000	-	-
Baffle Walls	$	75,000	75,000	-	-
Clearwell Top Slabs and Beams	$	200,000	200,000	-	-
Door Pads	$	5,000	5,000	-	-
Equpment/MCC Pads	$	5,000	5,000	-	-
Well pump pad raising	$	8,000	8,000	-	-
Precast lime injection vault and hatch	$	20,000	20,000	-	-
Drainage structures	$	15,000	15,000	-	-
Sidewalks/Curbs	$	40,000	40,000	-	-
DIVISION 4 - MASONRY:					
8" Structural Brick	$	219,000	219,000	-	-
Stone Coping	$	-	-	-	-
DIVISION 5 - MISC METALS:					
Pipe Supports	$	15,000	-	15,000	-
From Arch Estimate	$	6,000	6,000	-	-
Stairs and Railings and Platforms	$	50,000	50,000	-	-
Stn Stl Ladders	$	10,000	10,000	-	-
Grating and supports	$	20,000	20,000	-	-
DIVISION 6 - WOOD					
Glulam & Clevis Assembly	$	30,000	30,000	-	-
Misc framing	$	5,000	5,000	-	-
Shed roof framing	$	20,000	20,000	-	-
Curved roof framing	$	30,000	30,000	-	-

DIVISION 7 - THERMAL AND MOISTURE PROTECTION:					
Caulking/Sealant	$	3,000	3,000	-	-
Foundation dampproofing/Insulation	$	5,000	5,000	-	-
Standing Seam Roof	$	85,000	85,000	-	-
Siding at chimney	$	8,000	8,000	-	-
Gutters and leaders	$	5,000	5,000	-	-
Misc Trim & flashing	$	2,000	2,000	-	-
Closed cell foam insulation	$	15,000	15,000	-	-
DIVISION 8 - DOORS AND WINDOWS:					
Exterior doors	$	4,000	4,000	-	-
Roll-up Door	$	5,000	5,000	-	-
Interior door	$	2,000	2,000	-	-
Windows	$	21,000	21,000	-	-
Roof hatches	$	10,000	10,000	-	-
DIVISION 9 - PAINTING:					
Valve Tags	$	2,500	-	2,500	-
Valve Chart	$	1,000	-	1,000	-
Pipe Labels	$	2,500	-	2,500	-
Signs	$	2,500	-	2,500	-
Cement board trim & paint	$	15,000	15,000	-	-
Pipe Painting	$	10,000	-	10,000	-
Floor Painting	$	8,000	8,000	-	-
Doors Painting	$	3,000	3,000	-	-
DIVISION 13 - SPECIAL CONSTRUCTION					
Chemical Safety Panel	$	25,000	-	25,000	-
Flow Switches	$	10,000	-	10,000	-
SCADA Modifications	$	60,000	-	60,000	-
DIVISION 15 - MECHANICAL					
Gas Service	$	30,000	-	30,000	-
Gas heaters and piping	$	25,000	5,000	20,000	-
Fans and Louvers	$	15,000	15,000	-	-
DIVISION 16 - ELECTRICAL:					
MCC	$	100,000	-	-	100,000
Switchgear	$	50,000	-	-	50,000
Underground conduit and wire	$	75,000	-	-	75,000
Indoor power/control connections	$	50,000	-	-	50,000
Heaters	$	30,000	-	-	30,000
Indoor lighting	$	15,000	-	-	15,000
LIPA Costs	$	25,000	-	-	25,000
DIVISION 18 - PLUMBING:					
Chlorine and Lime injectors and tubing	$	10,000	-	10,000	-
Sequestering pump, piping and equipment	$	20,000	-	20,000	-
Layne Christensen Package	$	500,000	-	500,000	-
Tigg Off-Gas Treatment Unit	$	200,000	-	200,000	-
Transfer Pumps	$	50,000	-	50,000	-
Booster Pumps	$	60,000	-	60,000	-
Well 7A Pump Modifications	$	35,000	-	35,000	-
Well 8A Pump Modifications	$	35,000	-	35,000	-

Pump raising - misc piping	$	6,000		-		6,000		-
Buried Pipe, Fittings and valves	$	120,000		-		120,000		-
Exposed Pipe, Fittings and valves	$	120,000		-		120,000		-
Small Diameter Pipe and Fittings	$	25,000		-		25,000		-
Sump Pumps and piping	$	6,000		-		6,000		-
Cla-Vals	$	60,000		-		60,000		-
Venturi Meters	$	25,000		-		25,000		-
Flow Transmitters	$	6,000		-		6,000		-
Flow Switches	$	5,000		-		5,000		-
Chemical piping and valves	$	50,000		-		50,000		-
Air Release Valves and Piping	$	20,000		-		20,000		-
Subtotal GC, PC and EC Combined	$	3,581,000	$	1,674,000	$	1,547,000	$	360,000
Estimating Contingency at 10%	$	358,000	$	167,000	$	155,000	$	36,000
Total Estimated Project Cost	**$**	**3,940,000**	**$**	**1,840,000**	**$**	**1,700,000**	**$**	**400,000**
						check	$	3,940,000
Allowances	$	125,000		50,000		50,000		25,000
Totals with Allowances	**$**	**4,065,000**	**$**	**1,890,000**	**$**	**1,750,000**	**$**	**425,000**

Town of Hempstead Department of Water

Levittown Water District

Well 7A & 8A Packed Tower Aeration System Annual Operating Costs

A. Annual Electric Costs

Off Peak Season			**Peak Season**		
Demand	350	KW	Demand	350	KW
Monthly Demand Charge	$4.65	Per KW	Monthly Demand Charge	$18.96	Per KW
Season Duration	8	Months	Season Duration	4	Months
Total Demand Cost	$13,020		Total Demand Cost	$26,544	
Monthly Operating Hours[1]	240	Hrs	Monthly Operating Hours[2]	300	Hrs
Monthly Usage	84,000	KWH	Monthly Usage	105,000	KWH
Usage Charge	$0.0387	Per KWH	Usage Charge	$0.0477	Per KWH
Total Usage Cost	$26,006.40		Total Usage Cost	$20,034	
Total Electric Cost	$39,026.40		Total Electric Cost	$46,578	
Total Annual Electric Cost of New Water Supply Facilities				$85,604.40	

Notes: 1. Based on average day pumpage and pump flow rates (Two well pumps, two booster pumps, two transfer pumps and two blowers at 8 hours per day).
2. Based on maximum day pumpage and pump flow rates (Two well pumps, two booster pumps, two transfer pumps and two blowers at 10 hours per day).

B. Annual Carbon Costs

Annual Carbon Changes	6
Cost of Carbon Per Change	$50,000
Total Annual Carbon Cost	$300,000

C. Annual Costs Associated with 30 Year Life of New Equipment

	Well Pump (2)	Booster Pump (2)	Blower (2)
Rehabilitation Interval	5	5	5
Number of Rehabilitations Over 30 Years	4	4	4
Cost Per Rehabilitation	$5,000	$5,000	$1,000
Total Lifetime Replacement Cost	$20,000	$20,000	$4,000
Replacement Interval (Years)	15	15	15
Number of Replacements Over 30 Years	2	2	2
Cost Per Replacement	$65,000	$65,000	$40,000
Total Lifetime Replacement Cost	$130,000	$130,000	$80,000
Costs Associated with 30 Year Life of New Equipment			$768,000
Annual Costs Associated with 30 Year Life of New Equipment			$25,600

D. Sum of Operating Costs for Project

Annual Electric Usage and Demand Costs	$85,604.40
Annual Carbon Costs	$300,000
Annual Costs Associated with 30 Year Life	$25,600
Total Annual Operating Costs	**$411,204.40**

APPENDIX D

CARBON USAGE

Design Parameters:

TCE Loading: 4,412 lbs. of TCE/year (420 µg/L, 24 hours/day, 365 days/ year)

Carbon Usage Rate: 0.048 lbs. of TCE/lb. of Carbon (provided by manufacturer)

Carbon in Vessel: 16,000 lbs. of Carbon/Changeout (provided by manufacturer)

Carbon Changeout Rate Calculation:

4,412 lbs. of TCE/year ÷ 0.048 lbs. of TCE/lb. of Carbon = 91,920 lbs. of Carbon/year

91,920 lbs. of Carbon/year ÷ 16,000 lbs. of Carbon/Changeout = 5.75 Changeouts/year

365 days/year ÷ 4.18 Changeouts/year = **64 days/Changeout**

EXHIBIT D

TOWN OF HEMPSTEAD
DEPARTMENT OF WATER
LEVITTOWN WATER DISTRICT

Design Report
Packed Tower Aeration System
Well 13

August 2014
(Revised February 2016)

Prepared By:

D&B Engineers and Architects, P.C.
50 YEARS est. 1965

TOWN OF HEMPSTEAD

DEPARTMENT OF WATER

LEVITTOWN WATER DISTRICT

DESIGN REPORT

PACKED TOWER AERATION SYSTEM

WELL 13

Prepared By

D&B ENGINEERS AND ARCHITECTS, P.C.

WOODBURY, NEW YORK

AUGUST 2014

(REVISED FEBRUARY 2016)

•3402\KK04161401_Well 13(R03)

TOWN OF HEMPSTEAD
DEPARTMENT OF WATER
LEVITTOWN WATER DISTRICT
DESIGN REPORT
PACKED TOWER AERATION SYSTEM
WELL 13

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1.0 INTRODUCTION

1.1 General

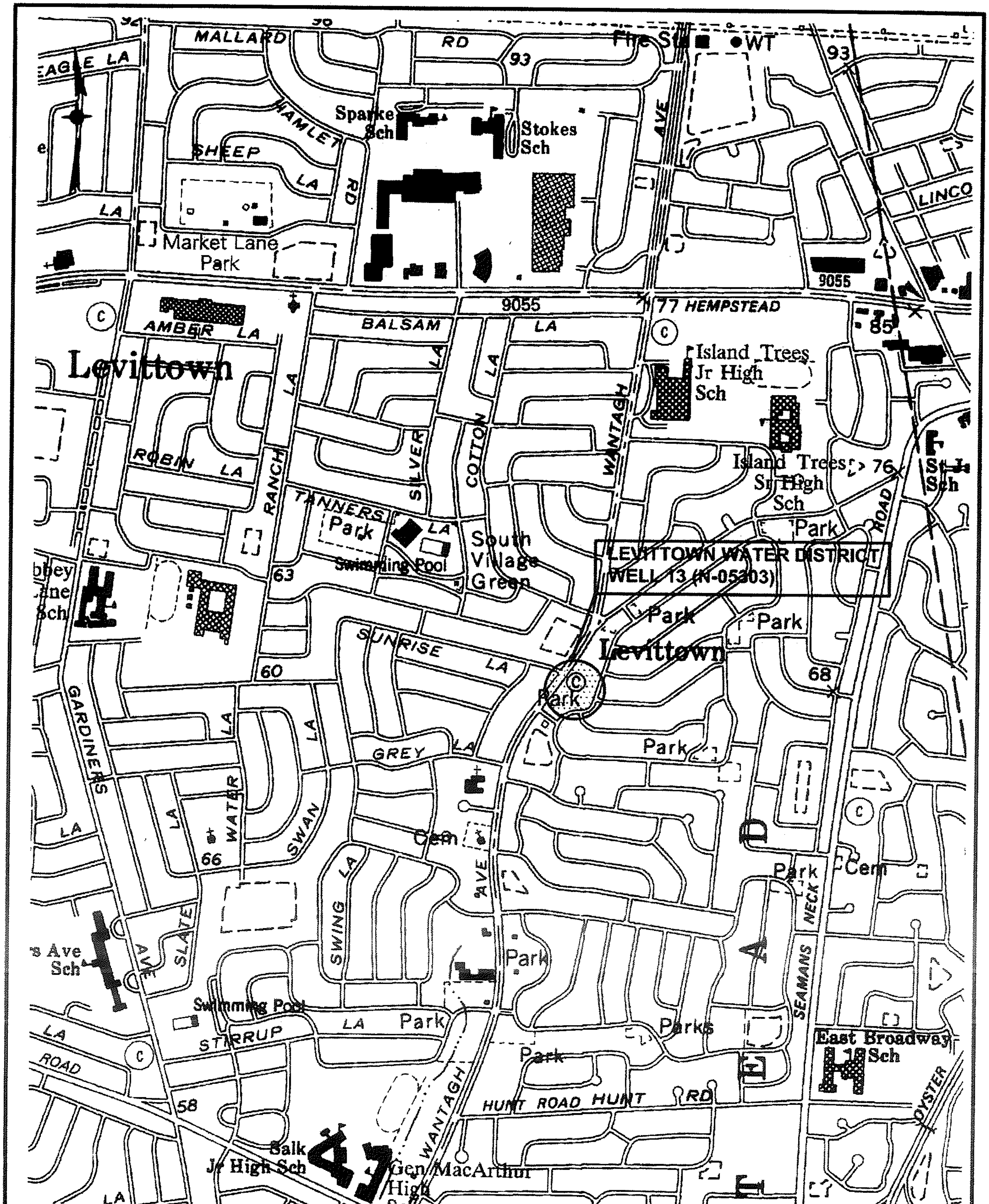
The Levittown Water District (LWD), which is operated by the Town of Hempstead Department of Water, serves a primarily residential area of approximately 3.9 square miles and approximately 50,000 residents. The Water District maintains 15 public water supply wells, 9 of which are currently in service. The location of Well 13 is indicated on **Figure 1-1**.

Starting in January 2012, the water in Well 13 exhibited trace concentrations of volatile organic compounds (VOCs). Between the beginning of 2012 and the date of this report, the water has exhibited increasing levels of primarily one volatile compound, 1,1,2-Trichloro-1,2,2-Triflouroethane (Freon 113). Samples collected on July 17, 2013 indicated that the concentrations of Freon 113 were approaching the maximum contaminant level (MCL) for these contaminants.

Since it is essential to maintain the use of Well 13 in order to reliably meet the demand for water in the Levittown Water District, the Water District plans to construct a packed tower aeration system to remove Freon 113 at Well 13. The proposed system will be constructed to receive the raw water flow from the existing well and will allow for chemical treatment (disinfection and pH adjustment) of the finished water prior to entering the distribution system.

1.2 Background Information

The facilities at the Well 13 site presently include one 1,200-gpm deep well turbine pump with 125-horsepower electric motor, sodium hypochlorite injection equipment for disinfection and lime injection equipment for pH adjustment. The equipment is housed within an aboveground well house. Physical data on Well 13 is as follows:



F:\3402\FIGURE\3402-FIG1.dwg, FIG-1, 6/17/2014 4:44:52 PM, slaun

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TOWN OF HEMPSTEAD DEPARTMENT OF WATER
LEVITTOWN WATER DISTRICT
PACKED TOWER AERATION SYSTEM - WELL 13

LOCATION MAP

N.T.S.

FIGURE 1-1

Well	13
NYSDEC No.	N-05303
Well Depth (ft)	741
Well Pump Capacity (gpm)	1,200
Well Pump Motor Horsepower	125
Well Pump RPM	1,770
Well Construction Date	1955

Regional groundwater flow in the vicinity of Well 13 is towards the south.

2.0 EXISTING FACILITIES AND WATER QUALITY HISTORY

2.1 Existing Facilities

The primary working components of the Levittown Water District water supply system at this time are: nine wells located at six stations, two elevated storage tanks capable of storing a total of 2.5 million gallons and a strong distribution system with major 10-inch and 12-inch loops. The Levittown Water District has five interconnections with neighboring water systems including one with Hicksville Water District, three with Bethpage Water District and one with East Meadow Water District. Four wells and four booster pumps are equipped with standby generators and two wells are equipped with auxiliary engines and right angle drives.

The average daily pumpage for the District in 2012 was approximately 4.85 million gallons per day (mgd) and the maximum day pumpage recorded on July 13, 2012 was approximately 11.11 mgd (7,715 gallons per minute).

The capacities of the nine wells in the system are indicated in **Table 2-1**. It is essential that all of the system wells be available in order to reliably meet demands such as maximum day, maximum hour, maximum day plus fire, a consecutive series of high demand days and average day demand during a power outage.

The water at Well 13 is treated with lime to increase the pH for corrosion control. In addition, sodium hypochlorite is added for disinfection. Both chemicals are currently injected in the well discharge piping within the well station, prior to entering the distribution system.

2.2 Water Quality History at Well 13

2.2.1 Volatile Organic Compounds

Well 13, which is 741 feet deep, and screened in the Magothy aquifer, has shown

Table 2-1

**LEVITTOWN WATER DISTRICT WELLS
GENERAL INFORMATION**

Well No.	Permit Capacity (gpm)	Actual Capacity (gpm)	Treatment*
1A	1,380	1,360	Packed Tower Aeration
2A	1,320	1,120	Packed Tower Aeration
5A	1,320	1,000	Packed Tower Aeration
6B	1,380	1,000	Packed Tower Aeration
7A	1,200	1,240	None
8A	1,200	1,100	None
12	1,200	1,000	None
13	1,200	1,200	None
14	1,200	370	None
Total		**9,390**	
With Largest Out		**8,030**	

*All wells receive lime and sodium hypochlorite as part of their treatment.

increasing levels of 1,1,2-Trichloro-1,2,2-Triflouroethane (Freon 113) in the past several months, as shown in **Table 2-2**. In July of 2013, the concentrations of Freon 113 neared the Maximum Contaminant Level (MCL) of 5.0 μg/l for this specific compound. In order for the District to continue to provide an adequate supply of water to the distribution system into the future, it is necessary to construct a treatment facility for removal of volatile organic compounds (VOCs) from this water source.

A radius search was performed to identify possible sources of the VOC contamination in Well 13 within an approximate 2-mile radius of the well. Based on the nature of the surrounding properties and information provided in the radius search, none of the surrounding properties within 2 miles represent possible sources of contamination for the LWD public water supply well. However, the Northrop Grumman Systems Corporation (Grumman) site is located approximately 2 to 2.5 miles north-northeast of the LWD public water supply wells, as depicted in **Appendix A.** Based on a groundwater flow direction to the south-southeast, the Grumman site is located up gradient of the LWD well. Thus the Grumman Superfund site was identified and considered as a possible source:

- Northrop Grumman Systems Corporation – ID# NYD002047967

According to various water quality reports obtained from the New York State Department of Conservation (NYSDEC), the Grumman site is divided into three operable units:

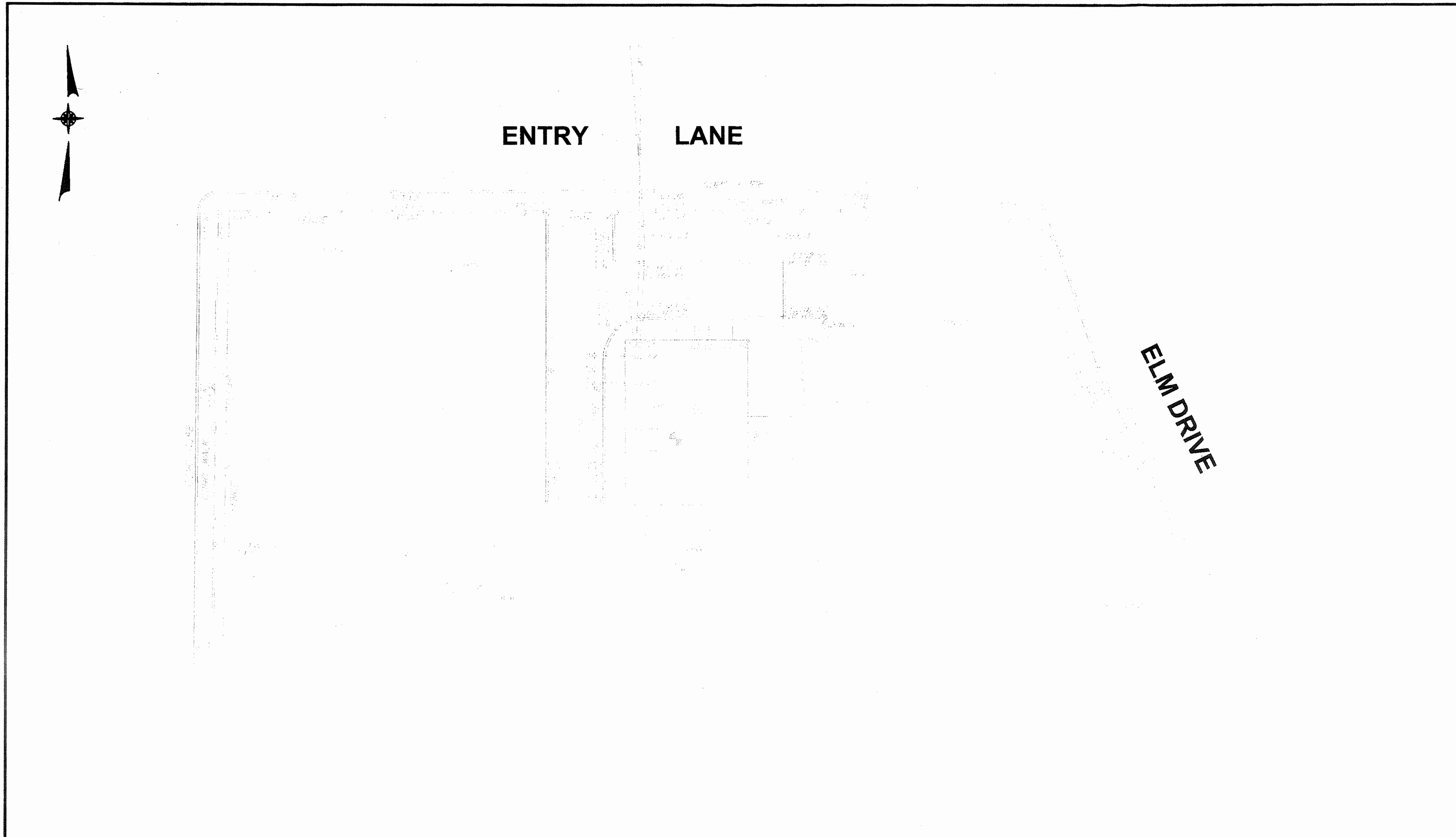
- Operable Unit 1 (OU-1) consists of the former manufacturing plant area;
- Operable Unit 2 (OU-2) consists of the groundwater contamination plume and is a joint operable unit for both the Grumman Site and a Naval Weapons Industrial Reserve Plant site; and
- Operable Unit 3 (OU-3) consists of the Former Grumman Settling Ponds, Grumman Access Road, some adjacent property and impacted groundwater which is not addressed by OU2.

Table 2-2
Levittown Water District Well 13
VOC and THM Sampling Data Summary

	Chemical	MCL (µg/L)	1/5/2012	1/6/2012	2/9/2012	2/22/2012	2/27/2012	3/7/2012	3/12/2012	3/21/2012	3/26/2012	4/4/2012	4/10/2012	5/2/2012	5/17/2012
Well 13 N-05303	1,1,2-Trichloro-1,2,2-trifluoroethane	5	N/D	1.6	1.7	1.9	2	2.2	2	1.7	1.5	2	1.9	1.15	2.1
	Total VOC	N/A	N/D	1.6	1.7	1.9	2	2.2	2	1.7	1.5	2	1.9	1.15	2.1
	Total THMs	80	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D

	Chemical		6/15/2012	7/20/2012	8/1/2012	9/6/2012	10/3/2012	11/1/2012	12/10/2012	1/10/2013	2/1/2013	6/4/2013	7/3/2013	7/17/2013	7/25/2013
Well 13 N-05303	1,1,2-Trichloro-1,2,2-trifluoroethane	5	1	N/D	N/D	N/D	1.58	N/D	0.9	1.5	2.9	1.65	3.21	3.82	3.7
	Total VOC	N/A	1	N/D	N/D	N/D	1.58	N/D	0.9	1.5	2.9	1.65	3.21	3.82	3.7
	Total THMs	80	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D

	Chemical		7/29/2013	11/20/2013	3/10/2014	4/21/2014	4/21/2014	Maximum
Well 13 N-05303	1,1,2-Trichloro-1,2,2-trifluoroethane	5	3.14	2.08	2.21	3.01	3.01	3.82
	Total VOC	N/A	3.14	2.08	2.21	3.01	3.01	3.82
	Total THMs	80	N/D	N/D	N/D	N/D	N/D	0



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TOWN OF HEMPSTEAD DEPARTMENT OF WATER
LEVITTOWN WATER DISTRICT
PACKED TOWER AERATION SYSTEM - WELL 13

EXISTING SITE PLAN

SCALE: 1"=20'

FIGURE: 2-1

F:\3402\FIGURE\3402-FIG-6.dwg, FIG-2, 6/17/2014 4:49:00 PM, slaun

Currently, a large VOC groundwater plume extends from the Grumman Site and is actively migrating towards the south-southeast. This VOC plume consists of the OU-2 groundwater plume and the OU-3 groundwater plume, which are comingled at certain depths; however, the OU-2 groundwater plume is significantly larger in area. The off-site OU-2 plume is larger than 3,000 acres in size and ranges from approximately 150 to 750 feet deep, extending into the deep Magothy aquifer, including to the depths of the LWD public water supply well screen zone. In addition to various chlorinated VOCs, polychlorinated biphenyls (PCBs) and metals, the OU-2 groundwater plume includes the contaminant detected in Levittown Water District Well 13.

Based on the various groundwater reports obtained from the NYSDEC, LWD Well 13 appears to be located along the southern edge of the OU-2 Grumman plume. As depicted in Appendix 1 there are few groundwater monitoring wells located in the immediate vicinity of the LWD well. Other than the outpost monitoring wells discussed below, the closest groundwater monitoring wells (GM-34D and GM-34D2) are approximately 1-mile north of the LWD well. These two wells are screened in the Magothy aquifer to a maximum depth of approximately 520 feet. The available data indicates consistent elevated VOC concentrations, with the most recent available data collected in June 2013 showing total VOC concentrations of up to 190 μg/l. In addition, the VOC detected in the LWD well are present at the GM-34 location.

Due to the known VOC contamination migrating from the Grumman site, the NYSDEC required that a Public Water Supply Contingency Plan (PWCP) be developed as part of the selected remedy. As such, Arcadis prepared a PWCP dated July 22, 2003, which consisted of groundwater plume modeling and selecting locations for the installation of outpost monitoring wells (OPMWs). OPMWs were proposed to be installed up gradient of select public supply wells in order to provide an early warning of VOC plume migration towards the public supply wells. Trigger values, representing maximum VOC concentration limits, were established for each of the OPMWs and were developed to provide for approximately five years early warning prior to VOCs being detected in the down gradient supply well. An exceedance of a trigger value requires two additional confirmatory rounds of sampling. If confirmatory sampling indicates that

a trigger value has been reached, wellhead treatment or comparable alternate measures would be provided, with negotiations to be conducted with the water district.

Based on the 2003 groundwater flow and solute transport modeling, the PWCP determined that municipal supply well N5303 (LWD Well 13) was a potential receptor of the groundwater plume, but influent concentrations would remain below 0.5 µg/l over a 30 year period. As discussed earlier, concentrations have exceeded that level in Well 13 just 10 years after the modeling was completed. Two OPMWs (BPOW-4-1 and BPOW-4-2) were installed approximately 700 to 800 feet up gradient of LWD Well 13, as a conservative measure. According to field measurements obtained from the Arcadis 2010 Annual Report, outpost monitoring wells BPOW-4-1 and BPOW-4-2 are approximately 692 and 764 feet in depth, respectively. The locations of the installed OPMWs are depicted in **Appendix A.**

D&B reviewed available analytical data for OPMWs BPOW 4-1 and BPOW 4-2 provided by NYSDEC. Analytical data made available to D&B includes data from the first quarter of 2010 through the second quarter of 2013; however, several rounds of analytical data throughout this time period were not available. Based on a review of the analytical data, total VOC concentrations in OPMWs BPOW 4-1 and BPOW 4-2 have exhibited an increasing trend, with Freon-113 consistently detected in these wells, and more recently 1,1-DCE and TCE. Freon-113 has been detected in OPMWs BPOW 4-1 and BPOW 4-2 at least as early as February 2010 with concentrations of 0.87 µg/l and 0.44 µg/l, respectively.

According to available information, the total VOC trigger value for the OPMWs of 1.5 µg/l was first exceeded in BPOW 4-1 in March 2012. Two rounds of confirmatory sampling at BPOW 4-1 (completed in May 2012) indicate that total VOCs exceeded the trigger value of 1.5 µg/l, at concentrations of 2.1 µg/l and 1.9 µg/l, respectively. In addition, BPOW 4-2 first exceeded the trigger value in the fourth quarter of 2012. It is important to note that both BPOW 4-1 and BPOW 4-2 continue to exceed the trigger value, including during a recent sampling event during the second quarter of 2013, with total VOC concentrations of 4.0 µg/l and 1.8 µg/l, respectively.

Based on the EDR review and review of available documentation associated with the Grumman Site, it is likely that the VOCs detected in the LWD well are attributable to the VOC plume migrating from the Grumman Site, specifically the OU-2 groundwater plume. Quarterly groundwater sampling data obtained from NYSDEC indicates that the Grumman plume contains the VOC detected in the LWD well, and is present at similar depths as the screen zones of the LWD well. The VOC detections discussed above in OPMWs located immediately up gradient of the LWD well indicate that groundwater in the vicinity of the LWD well is impacted with Grumman-related VOCs. According to the PWCP, the trigger value exceedances detected at OPMW BPOW 4-1 indicate that the water district should be provided with remedial measures to protect the LWD well.

2.2.2 Iron, Manganese and Nitrate (as N)

The concentration of iron in Well 13 is below the detection limit of 0.02 mg/l and should not interfere with the effective performance of the packed tower aeration system. The concentration of manganese in Well 13 is below the detection limit of 0.01 mg/l and should not interfere with the effective performance of the packed tower aeration system.

The nitrate concentration in Well 13 was 1.26 mg/l during 2013, which is below the MCL of 10.0 mg/l and is not considered to be a threat to the continued use of the well.

3.0 TREATABILITY EVALUATION

A packed tower aeration system will effectively treat the organic compound detected in Levittown Water District's Well 13. Design criteria for the proposed packed tower aeration system are developed in this section.

3.1 Design Compounds

The contaminant observed in Well 13 that has exhibited an increasing trend in recent months is 1,1,2-Trichloro-1,2,2-Triflouroethane (Freon 113). It is projected that the trend may continue and the concentrations of the contaminant may significantly exceed the concentrations of other trace compounds detected in the well to date. Additionally, the plume from which these compounds originated contains up to 420 μg/l of Trichloroethylene (TCE) which, if the plume continues as it has been, may ultimately reach Well 13. Thus the design compounds for the treatment system have been determined to be Freon 113 and TCE.

Dilute solutions containing organic compounds, such as contaminated groundwater, behave according to Henry's Law, which states that at any interface between aqueous (liquid) and gaseous (air) phases, the concentration of a compound at the interface follows a linear relationship, as follows:

$$C_g = HC_L$$

where C_g = molar concentration of compound at gas phase interface

C_L = molar concentration of compound at liquid phase interface

H = Henry Constant (unitless)

Compounds with relatively high Henry Constants tend to transfer readily from liquid to gas phases and as a result, are generally well suited for treatment using packed tower aeration.

Henry Constants for the design compounds for the Well 13 treatment system, as determined by the USEPA are listed in **Table 3-1**.

Table 3-1

HENRY CONSTANTS FOR WELL 13 DESIGN COMPOUNDS

Design Compounds	Henry Constant @ 10° C (Unitless)
1,1,2-Trichloro-1,2,2-Triflouroethane (Freon 113)	16
Trichloroethylene (TCE)	0.42

These compounds exhibit Henry Constants which are within the ability of packed tower aeration to effectively reduce the concentrations of these organic contaminants from the groundwater.

3.2 Required Organic Removal Efficiency

The packed tower aeration system proposed for Well 13 will be designed to provide effluent concentrations of less than 20 percent of the New York State Department of Health (NYSDOH) drinking water standard for each design organic compound. This criterion suggests a maximum design effluent concentration of 1.0 µg/l for each of the design compounds. At no time will effluent organic concentrations exceed NYSDOH drinking water standards.

The design influent VOC concentrations will be determined by the maximum measured concentrations of each of the contaminants upstream of Well 13 as provided by the NYSDEC for the Grumman OU-2 plume. The maximum concentrations in the plume at the approximate depth of the Well (740 ft.) are presented in **Table 3-2**.

Table 3-2

MAXIMUM CONCENTRATIONS DETECTED IN THE GRUMMAN OU-2 PLUME FOR WELL 13 DESIGN COMPOUNDS

Design Compounds	Maximum Concentration Detected in Grumman OU-2 Plume (2012) (Influent Design Criteria) (μg/l)	Required Removal Efficiency (%)
1,1,2-Trichloro-1,2,2-Triflouroethane (Freon 113)	8.6	88.37
Trichloroethylene (TCE)	420	99.76

These concentrations far exceed the maximum influent concentrations reported in Well 13. The removal efficiency required to provide an effluent concentration of 1.0 μg/l at these influent concentrations is presented in **Table 3-2.**

3.3 DAR-1 Analysis

An initial screening of the packed tower emissions source impacts was completed using the NYSDEC's DAR-1 modeling software. This modeling allows for the determination of long-term (annual) and short-term (1 hour) impacts of the tower emissions on surrounding areas. The model was used on the wells to determine if there would be any impacts from any of the tower's influent constituents. The parameters used in this model are shown in **Table 3-3** below. For our packed tower aeration system the only constituent that violated the Annual Guideline Concentration (AGC) set forth by the NYSDEC was Trichloroethylene (TCE).

Table 3-3

MODEL PARAMETERS FOR DAR-1 ANALYSIS OF THE PACKED TOWER AERATION SYSTEM

Design Parameters	Packed Tower Aeration System	Vapor-Phase GAC Off-Gas Treatment System Effluent
Water Flow Rate	1,200 GPM	1,200 GPM
Model Height Above Structure	29 ft	10 ft
Model Stack Height	44 ft	20 ft
Stack Outlet Diameter	63 in(1)	20 in(2)
Exit Temperature	52° F	52° F
Model Exit Velocity	0.01 ft/s(3)	42.9 ft/s
Model Exit Flow Rate	0.01 ACFM(3)	5,615 ACFM
Shortest Distance to Property Line	45 ft	45 ft
Building Width	22 ft	22 ft
Building Length	40 ft	40 ft
Direction Building Length is Facing	90°	90°
UTME	626623	626623
UTMN	4508181	4508181
UTM Zone	18	18

Notes: 1. An equivalent outlet diameter has been calculated to equate to the dimensions of the tower vent ring.
2. An equivalent outlet diameter has been calculated to equate to the dimensions of the off-gas treatment vent stack.
3. At the NCDH's request, exit velocity and flow rate are considered to be negligible due to the PTAS horizontal exhaust condition.

The model determined that TCE at its maximum design influent concentration of 420 μg/l will be present in the packed tower emissions in sufficient quantity to violate the AGC of 0.2 $\mu g/m^3$. An influent water TCE concentration of 420 μg/l produced a maximum of 1.59 $\mu g/m^3$ of air emissions at 134 feet from the tower when the ISCLT2 Model was utilized. The Short-term Guideline Concentration (SGC) of 40,000 $\mu g/m^3$ was not violated under any condition. The lowest concentration of TCE which will cause a violation of the AGC to occur is 52 μg/l. Additionally, at 420 μg/l of TCE, the tower would only be allowed to operate

1,084 hrs/yr before violating the AGC. If a vertical discharge arrangement is utilized, the tower will violate the AGC at an influent concentration of 225 μg/l which would equate to an operational period of 4,640 hrs/yr. Due to the fact that the design influent concentrations of TCE cause a violation of the AGC it is necessary for the District to install off-gas treatment at Well 13.

Because the District requires use of this station at all times, reducing the usage of the well is not an option, nor was it found to be particularly effective at reducing the concentration of TCE at the property line. Therefore a method of treating the off-gas to below the NYSDEC DAR-1 limits must be utilized. The most common method of off-gas treatment utilizes vapor phase activated carbon to adsorb and remove the VOCs from the off-gas. These systems are capable of 95% removal of VOCs from the off-gas of the packed tower aeration system. When one of these systems was incorporated into the DAR-1 modeling by decreasing loading of VOCs to 5% of their design amounts and releasing the effluent from the vapor phase carbon system at a height of 20 feet using a vertical discharge the maximum concentration of TCE observed by ISCLT2 falls to 0.0567 $\mu g/m^3$ at 148 feet from the tower, which is well below both the SGC and AGC limits. The maximum allowable influent concentration (assuming 95% removal by the off-gas system) was determined via DAR-1 and ISCLT2 to be 1,470 μg/l of TCE which resulted in an emissions concentration of 0.199 $\mu g/m^3$ at 151 feet from the tower when the ISCLT2 Model is utilized. Freon 113 is not readily treated by carbon adsorption, however, with a maximum projected influent concentration of 8.6 mg/L the resulting concentration in the off-gas will be 0.022 ppb, well below the AGC of 180,000 ppb. Thus a packed tower aeration system with a vapor phase activated carbon adsorption system for off-gas treatment is an acceptable solution.

One alternative for off-gas treatment that needs to be considered is installation of a rotor concentrator thermal oxidation system. The rotor concentrator thermal oxidation system for the treatment of off-gas is not a feasible alternative for the following reasons:

- A waste stream will be produced and need to be contained and disposed of.
- Secondary emissions of the oxidization process include NOx, CO, and HCl in concentrations which would exceed the AGCs put forth in DAR-1.

Other alternatives to packed tower aeration treatment at Well 13 that need to be considered are installation of a GAC adsorption treatment plant at the site and drilling of a new well elsewhere in the District. Implementing GAC adsorption treatment at Well 13 for the removal of the VOCs is not a feasible alternative for the following reasons:

- One of the influent contaminants, Freon 13, cannot be readily treated by GAC adsorption.
- The operating cost for replacing the GAC media will be significant due to the high design concentrations of TCE in the source water.

Installation of a new well at a different site within the District is also not a feasible alternative to packed tower aeration treatment for the following reasons:

- Any new wells would require the District to purchase additional property on which to site the wells which would amount to a larger capital cost than the proposed improvements to the existing site.
- Sections of the District are in the likely path of the plume and would thus be unsuitable as a new water source without treatment similar to that to be installed at Well 13.
- Presence of nitrates at some locations within the District where existing wells have been abandoned.

Considering the above, the installation of a packed tower aeration system is the preferred treatment alternative for Well 13.

4.0 PROPOSED TREATMENT SYSTEM

The packed tower aeration system will be designed for a flow rate of 1,200 gpm, which is the District's maximum pumping rate for the well. The system will consist of a single packed tower, a concrete clearwell below the tower, one centrifugal blower and one vertical turbine pump to deliver treated water from the clearwell into the distribution system. A granular activated carbon off-gas treatment system will treat the off-gas of the tower. The associated controls and electrical systems will be located in the new aeration building. The existing chemical treatment systems shall be maintained in the existing well building, and the packed tower system effluent piping will be routed past the well building for chemical injection.

The proposed packed tower aeration system will be located to the west of the existing Well building. This portion of the site is currently unoccupied.

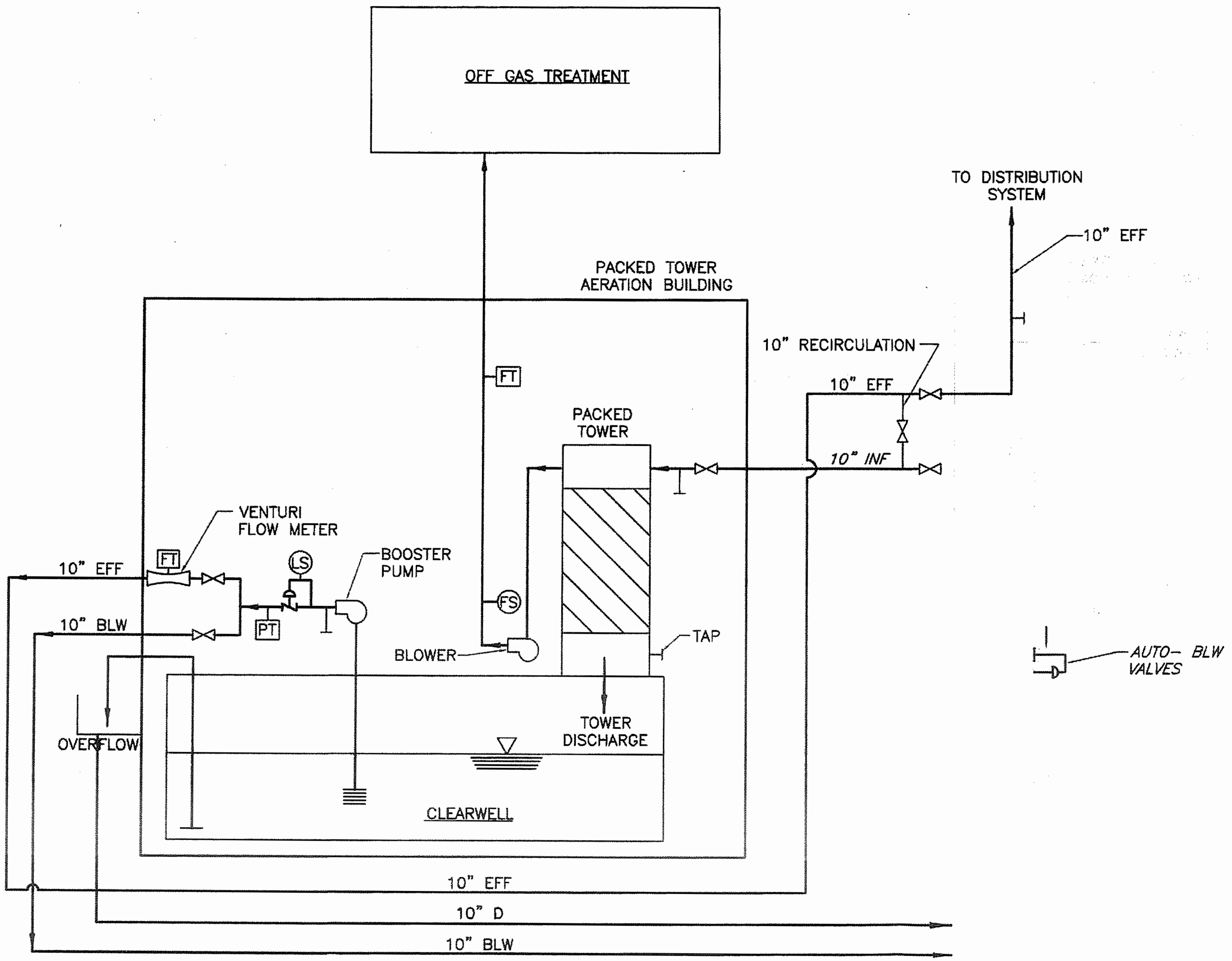
Figure 4-1 shows a schematic of the proposed piping for the packed tower aeration system in conjunction with the existing well station. **Figure 4-2** shows the proposed site plan.

4.1 Packed Tower Aeration System

The packed tower aeration system will be designed for a maximum flow of 1,200 gpm and influent concentrations of 420 μg/l of Trichloroethylene (TCE). The treatment system will be designed to reduce this compound to a concentration of 1.0 μg/l or less.

The existing well pump will be replaced with a new pump designed for the reduced total dynamic head conditions that will result from installation of the aeration treatment system. The modified well pumps will pump influent into the upper distribution tray of the packed tower.

A tower height of 44 feet will be required with a diameter of 8 feet 3 inches and a packing bed depth of 34 feet. The packing media will be 2.0-inch Jaeger Tripacks. The air flow rate will be 5,615 cfm creating a volumetric air to water ratio of 35:1. **Table 4-1** summarizes the packed tower aeration system design parameters.



LEGEND

BLW	BLOWOFF
D	GRAVITY DRAIN
DIS	BOOSTER PUMP DISCHARGE
INF	PACKED TOWER INFLUENT
REC	RECIRCULATION
SS	SAMPLING SERVICE
FS	FLOW SWITCH
FT	FLOW TRANSMITTER
LS	LIMIT SWITCH
PT	PRESSURE TRANSMITTER
	CHECK VALVE
	GATE VALVE
	BOOSTER PUMP/BLOWER
M	MOTORIZED BUTTERFLY VALVE
	HYDRAULIC CONTROL VALVE
	SAMPLE TAP
	EXISTING
	PROPOSED

F:\3402\FIGURE\3402-FIG-5.dwg, FIG-4-1, 6/17/2014 4:53:25 PM, slaun

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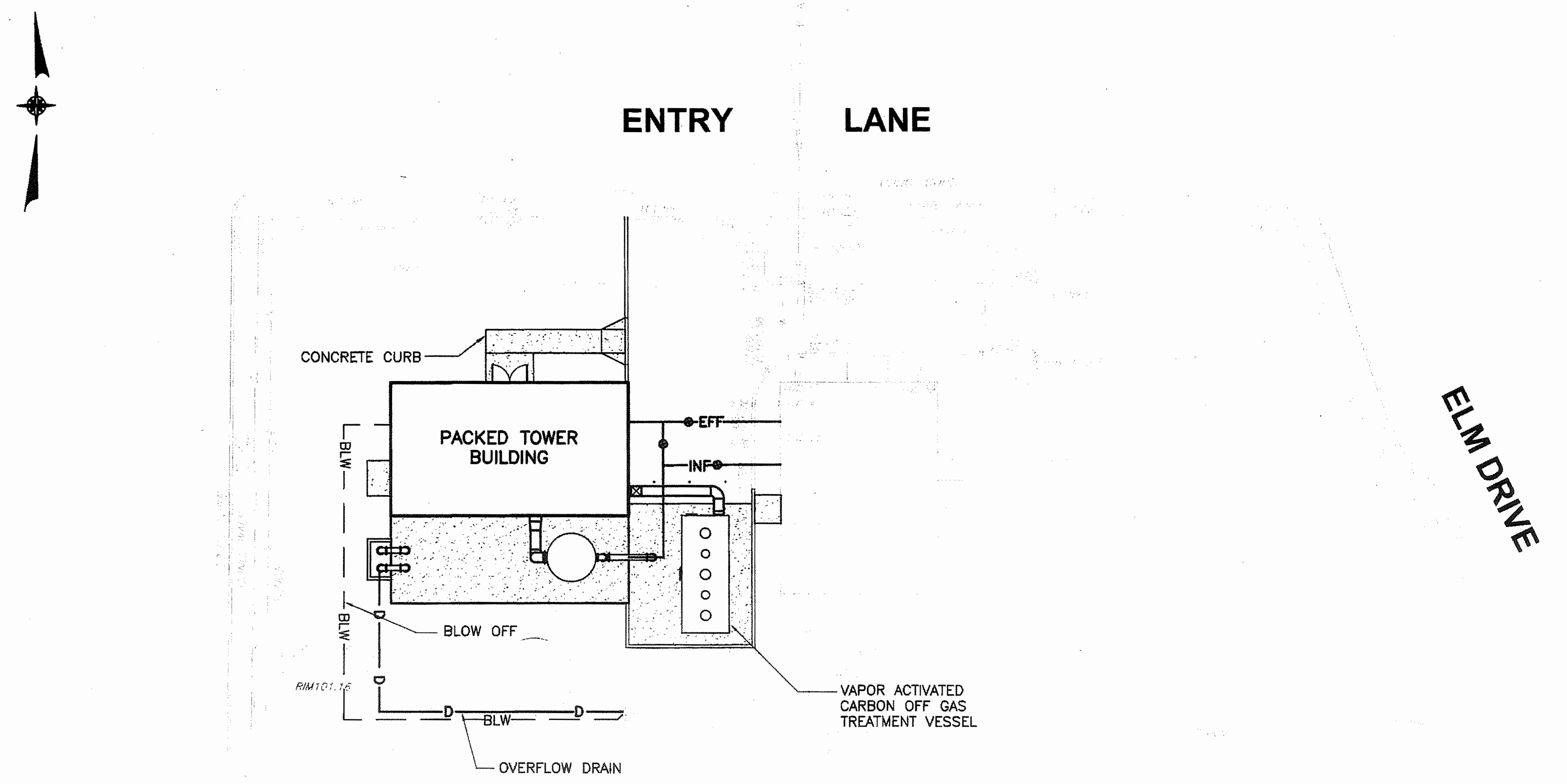
TOWN OF HEMPSTEAD DEPARTMENT OF WATER
LEVITTOWN WATER DISTRICT
PACKED TOWER AERATION SYSTEM - WELL 13

PIPING SCHEMATIC

N.T.S.

FIGURE: 4-1



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LEVITTOWN WATER DISTRICT
PACKED TOWER AERATION SYSTEM - WELL 13

PROPOSED SITE PLAN

SCALE: 1"=20'

FIGURE: 4-2

F:\3402\FIGURE\3402-FIG-6.dwg, FIG-4, 6/17/2014 4:51:57 PM, slaun

Table 4-1
SUMMARY OF PACKED TOWER AERATION SYSTEM DESIGN PARAMETERS

Design Parameter	Value
Water Flow Rate	1,200 gpm
Air To Water Ratio	35:1
Air Flow Rate	5,615 cfm
Number of Towers	1
Tower Diameter	8 feet 3 inches
Packed Bed Depth	34.0 feet
Overall Height	44.0 feet
Influent Concentration(1)	420 μg/l
Effluent Concentration(1)	1.0 μg/l

(1) Design volatile organic compound (VOC) is TCE.

The tower will be constructed of structural grade aluminum and will be designed to withstand all potential live, dead, wind and earthquake forces as required by the New York State Building Code. The internal tower components will be designed to achieve maximum air and water distribution throughout the tower. Six access manways will be provided along the tower shell, one immediately above the influent distribution tray, one at the top of the upper packing media, one at the bottom of the upper packing media, one immediately above the re-distributer tray, one at the top of the lower packing media, and one at the bottom of the lower packing media.

The tower will be mounted on top of the reinforced concrete clearwell with the base of the tower approximately 0.5 feet above grade elevation. Treated water will be discharged from the tower directly into the clearwell below.

4.2 Blower

The blower will be a centrifugal fan which will draw ambient air through an intake louver, air filter, acoustical silencer, through the clearwell, upwards through the packed tower

and out of the upper air vents of the packed tower. The blower will then discharge into ductwork which will send the tower off-gas through a vapor phase activated carbon treatment system and then discharge directly from the off-gas treatment system at a point approximately 10 feet above grade. An airflow meter will be installed on the suction side ductwork of the blower. The blower will have a capacity of 5,615 cfm and will be equipped with a 20-horsepower electric motor. The blower orientation allows for the use of only one blower which can handle both the airflow required by the tower for treatment and the discharge to the off-gas treatment system.

4.3 Booster Pump

The booster pump will be the vertical turbine type with a capacity of 1,200 gpm at 1,760 rpm. The booster pump leaving the clearwell will operate at approximately 187 feet of dynamic head to exceed the distribution system pressure. The booster pump motor will be 100 horsepower. The booster pump motor will reuse the existing 100 horsepower well pump motor if it is found to be suitable after inspection. The discharge pipe from the booster pump will be directed back through a new chemical injection vault outside the well building for lime injection. A backpressure control valve will be provided for the booster pump in the new aeration building and will control the booster pump flow into the distribution system. The treatment system will discharge into the District's distribution system at one location, consistent with the existing well pump discharge configuration.

4.4 Blow-off Piping

A 6-inch blow-off pipe with a manually operated gate valve will permit the discharge from the booster pump to be diverted to the existing well blow-off pit if it is necessary to waste packed tower effluent water rather than pump it to the distribution system. The blow-off pit is connected to a sump which has a maximum capacity of approximately 300,000 gallons and which allows the water to drain into the soil. The existing well blow-off system is currently connected to the existing blow-off pit and can accommodate wasted packed tower effluent generated during disinfection and sampling of the system. However, the existing well blow-off system is manually operated and will be replaced with an automatic well blow-off system.

4.5 Well Pump

The existing well pump will be removed and replaced with a new pump designed to operate at a reduced total dynamic head. The new operating condition for the well pump will be 1,200 gpm at 104 feet of total dynamic head. The existing 100 horsepower motor will be removed and replaced with a 50 horsepower motor. The existing back pressure control valve in the well house will remain and operate under the new total dynamic head conditions of the modified system.

4.6 Off-Gas Treatment

An off-gas treatment system will be provided to remove any contaminants from the packed tower aeration system off-gas. The system will consist of one vapor phase activated carbon adsorption unit as well as all associated ductwork. The carbon adsorption unit will contain 11,000 lbs. of virgin vapor phase activated carbon to treat the VOCs present in the packed tower off-gas and will be located outside of the treatment building. The carbon adsorption unit will be designed for operation at 100% humidity. The adsorption rate for the TCE under 100% humidity conditions will be 0.048 lbs. of TCE per lb. of carbon which at the design concentration of 420 µg/L will result in a change out of the carbon every 87 days when operating 24 hours per day at the maximum influent concentration of 420 ppb. Under 50% humidity conditions the adsorption rate for TCE would be 0.08 lbs. of TCE per lb. of carbon which at the design concentration of TCE would result in a change out of the carbon every 146 days. However, dehumidification to 50% is not feasible due to the creation of a liquid waste stream contaminated with TCE and the other present VOCs condensed from the humid air. Additionally, the costs of heating the air for dehumidification would be excessive. The effluent air of the adsorption units will be discharged from the top of the treatment vessel through a 10 foot vertical duct supplied by the manufacturer, releasing at a height above ground of 20 feet. The vapor phase activated carbon unit will have sample taps for sampling the carbon. The 75% bed depth sample tap will also be provided with a non-selective visual VOC breakthrough detector to assist in determining breakthrough point.

4.7 Chemical Treatment

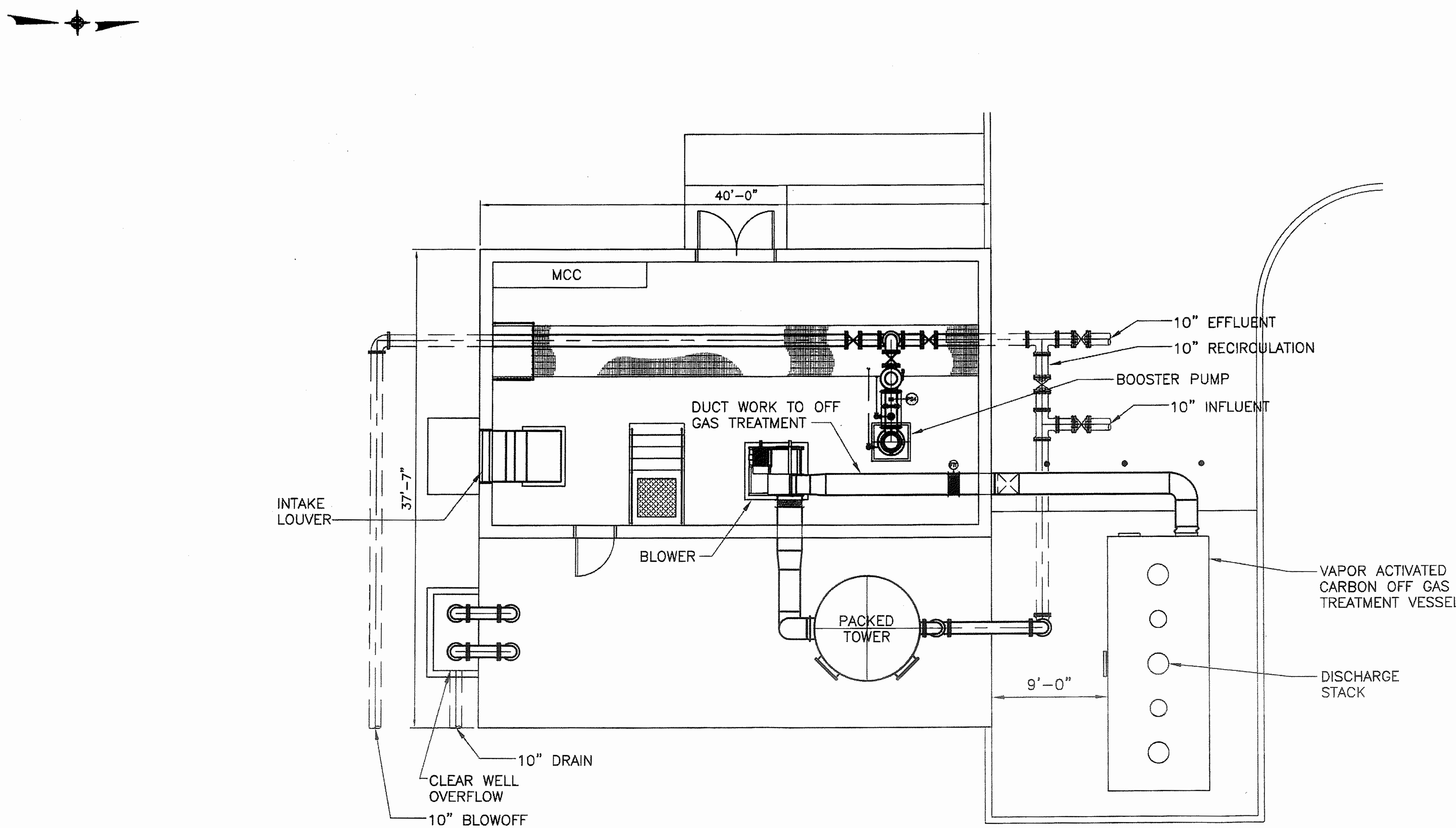
The existing lime tank and metering pump and sodium hypochlorite injection system are located inside of the existing well building. The current injection points for chemical treatment are located in the well effluent line leaving the building. The sodium hypochlorite injection point will remain in the existing location upstream of the packed tower aeration system and will have its dose adjusted to provide an appropriate residual concentration leaving the plant. However, the lime injection point must be relocated downstream of the new packed tower to prevent accumulation of lime within the packed tower. To achieve this, the packed tower aeration system effluent pipe will be routed back through the well building, and the lime piping will remain at the same location within the well building to provide for pH adjustment of the treatment system effluent. The existing water sampling line and analyzer equipment will remain in the well building.

The existing chemical safety panel utilizes the well pump motor interlock, a limit switch on the well pump backpressure control valve, and a pressure switch on the well pump discharge pipe as the three safeties. The chlorine injection safeties will continue to operate with the current setup however, the lime injection safeties must be modified to operate in conjunction with the new booster pumps instead of the well pumps.

A new flow switch will be installed on each of the treated water pipes where the treated water leaves the aeration building, and limit switches will be installed on the new backpressure control valves in the aeration building. A new chemical safety panel will be installed in the well house to use these safeties as well as an electrical interlock with the new booster pump motor starter to permit lime metering pump operation.

4.8 Aeration Building

Figure 4-3 shows a floor plan of the proposed aeration building. The building will be constructed on top of a reinforced concrete clearwell. The packed tower will be mounted on top



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TOWN OF HEMPSTEAD DEPARTMENT OF WATER
LEVITTOWN WATER DISTRICT
PACKED TOWER AERATION SYSTEM - WELL 13
AERATION BUILDING PLAN

SCALE:1/8"=1'-0"

FIGURE: 4-3

F:\3402\FIGURE\3402-FIG-5.dwg, FIG-4-3, 6/17/2014 5:11:57 PM, slaun

of the clearwell outside of the building. The clearwell will be constructed with baffle walls to eliminate dead zones. The building floor will be 0.5 feet above the existing grade elevation and the building will contain the booster pump, blower, motor control center, packed tower control panel, and appurtenances. The aeration building will be classified as a Utility and Miscellaneous Group U building according to the Building Code of New York State.

A hatch will be provided in the roof of the building to facilitate removal of the vertical turbine booster pump, and an access hatch will be installed on the clearwell top slab to permit access to the clearwell. The aeration building will have one double door to allow removal of the blower and control equipment and for daily operations access.

Since the clearwell is located below grade, the overflow for the clearwell must exit through the top slab of the clearwell and terminate in a gooseneck at least 1 foot above grade. This sets the clearwell overflow elevation at 3'-0" above the finished floor. In order to prevent the packed tower building from flooding due to a potential clearwell overflow all equipment penetrations in the clearwell and the clearwell access hatches must be extended 3'-6" above the finished floor of the building.

4.9 Site Plan

Figure 4-2 shows the proposed site plan. The packed tower and aeration building serving Well 13 will be located to the west of the existing well building. New below-grade piping will be constructed to direct raw water into the packed tower aeration system. New below-grade piping will direct packed tower effluent back into the well building for pH adjustment, and into the distribution system. A new below-grade blow-off pipe will convey wasted water from the packed tower into the existing blow-off pit. Clearwell overflow will be routed into the existing blow-off pit and then on to the drainage sump by means of new gravity drainage pipe. A standby generator will be installed at the site to power the existing well and proposed treatment equipment. Additionally all asphalt pavement on the site will be replaced.

4.10 Sampling Taps

An existing sampling tap on the Well 13 discharge piping will permit the sampling of raw well prior to treatment, a new sampling tap will be installed on the influent piping of the tower and a new sampling tap will be provided on the base of the tower shell to allow a treated water sample to be collected. A new sampling tap on the booster pump discharge piping will permit collection of a water sample from the clearwell. An existing sample tap downstream of the lime injection will allow collection of treated water prior to entering the distribution system.

4.11 Control System

The operation of the existing well pump and the new blower will be coordinated for proper operation of the packed tower aeration system. There will be two different modes of operation of the packed tower aeration system. These modes are designed around providing water immediately upon a call for water in the system. To this end the system will always terminate with the clearwell full. The two modes that will be available will be SCADA Initiated and Locally Initiated.

The operating sequence under SCADA initiated flow will be to start the Booster Pump upon a call for water. Upon this trigger the blower begins to operate. After confirmation that the blower is operating, the well pump will be started. Failure of the blower to operate will prevent operation of the well pump. Three separate safety devices (an electrical motor starter interlock, amperage meter and a pressure sensor) must detect blower operation before the well pump will be permitted to start. The well pump will initially run to blowoff for a preset time before being diverted to the packed tower by automatically actuated valves. A variable frequency drive (VFD) on the booster pump will maintain the level in the clearwell increasing or decreasing its flow rate in respect to an operating level set on the pressure transducer. During operation, if a low level float or pressure transducer setting is triggered, the booster pump will stop; however, the well pump and blower will continue to run to refill the clearwell. When the call for water ends, the booster pump will immediately cease operation. Following this, the well pump and blower will continue to run until the high level float switch or transducer set point in the

clearwell is reached. When the high level set point is reached, the well pump will shut down immediately and the automatic blowoff valve will open. The blower will continue to run on a preset timer to ensure that all water has been treated before entering the clearwell. When the timer has expired, the blower will shutdown.

An emergency high-high level float switch in the clearwell will trigger a high level alarm and shut down the well pump and the blower to prevent a clearwell overflow condition. An emergency low-low level float switch in the clearwell will trigger a low level alarm and shut down the booster pump to prevent a water level below the level required for proper pump operation. Manual reset will be required for either high level alarm or low level alarm before returning to normal operating mode. The control system will feature a selector switch which will allow control of the well pump from either the electronic pressure transducer or the float switches.

Locally initiated well flow mode will operate identically to the SCADA initiated well flow mode with the exception of the call for water which will be initiated from a local pressure switch. Local control will only operate in the absence of SCADA control or when the switch is in local mode.

5.0 INFRASTRUCTURE SECURITY

In accordance with Ten State Standards, Recommended Standards for Water Works "Policy Statement on Infrastructure Security for Public Water Supplies", existing security features of the facility are reviewed and improvements to reduce vulnerability to intentional acts of vandalism, sabotage, and terrorism are evaluated for inclusion in the project.

The Well 13 property is protected from unauthorized entry by a continuous 6-foot chain link fence and gates that are maintained locked throughout the day. To monitor the buildings within the unmanned facility, the Town utilizes a Supervisory Control and Data Acquisition (SCADA) system to provide access control and to monitor for unauthorized entry into each building. Access control is granted for each authorized plant operator through the use of a magnetic key issued to each individual that is uniquely coded to identify the individual and their respective access permissions. Authorization to enter the site disarms the alarm monitoring system at the site. The alarm system is activated each time an operator leaves the site. The alarm system serves to prevent and alert the Town of unauthorized entry into a building through the use of door switches within each building. All critical equipment components of each treatment process; including water treatment chemical storage is maintained within buildings that are integrated into the access control and alarm system. The proposed packed tower aeration building on site will be integrated into the Town's existing access control and alarm system through SCADA. Where glass windows exist, the openings are obstructed with masonry block to discourage unauthorized entry. Site lighting is automatically illuminated each night to discourage unauthorized entry and aid in the detection of intruders. The facility is equipped with signage to encourage the public to report any suspicious activity in the area of the site.

The Town of Hempstead has standardized on certain sizes of well pump motors, chemical feed pumps and instrumentation devices to allow for interchangeability of equipment should critical station components fail or become damaged. This program allows for key system components to be maintained in storage, preventing procurement lead times associated with the purchase of major components. For packed tower systems the Town maintains spare blower

belts and air filters at the site to maintain an inventory of replacement parts and reduce the possibility of station downtime in the event that equipment is damaged or expended.

At this time, the existing security and access prevention measures at the Well 13 facility are considered to be adequate to mitigate the threat of illegal tampering with the water supply system. The new facility design will match the Town's standards.

6.0 COST ESTIMATE

The purpose of this construction cost estimate is to provide the Town with a budgetary value for funding the construction of the proposed packed tower aeration system. The estimate is based on the conceptual design as presented in this report.

Costs are based on manufacturer quotes for major equipment items and on other similar projects which have been recently completed. All costs include a 10-percent estimating contingency. Engineering and administrative fees are not included in the estimate. A breakdown of the cost estimate, as well as an operation and maintenance cost estimate can be found in **Appendix C.**

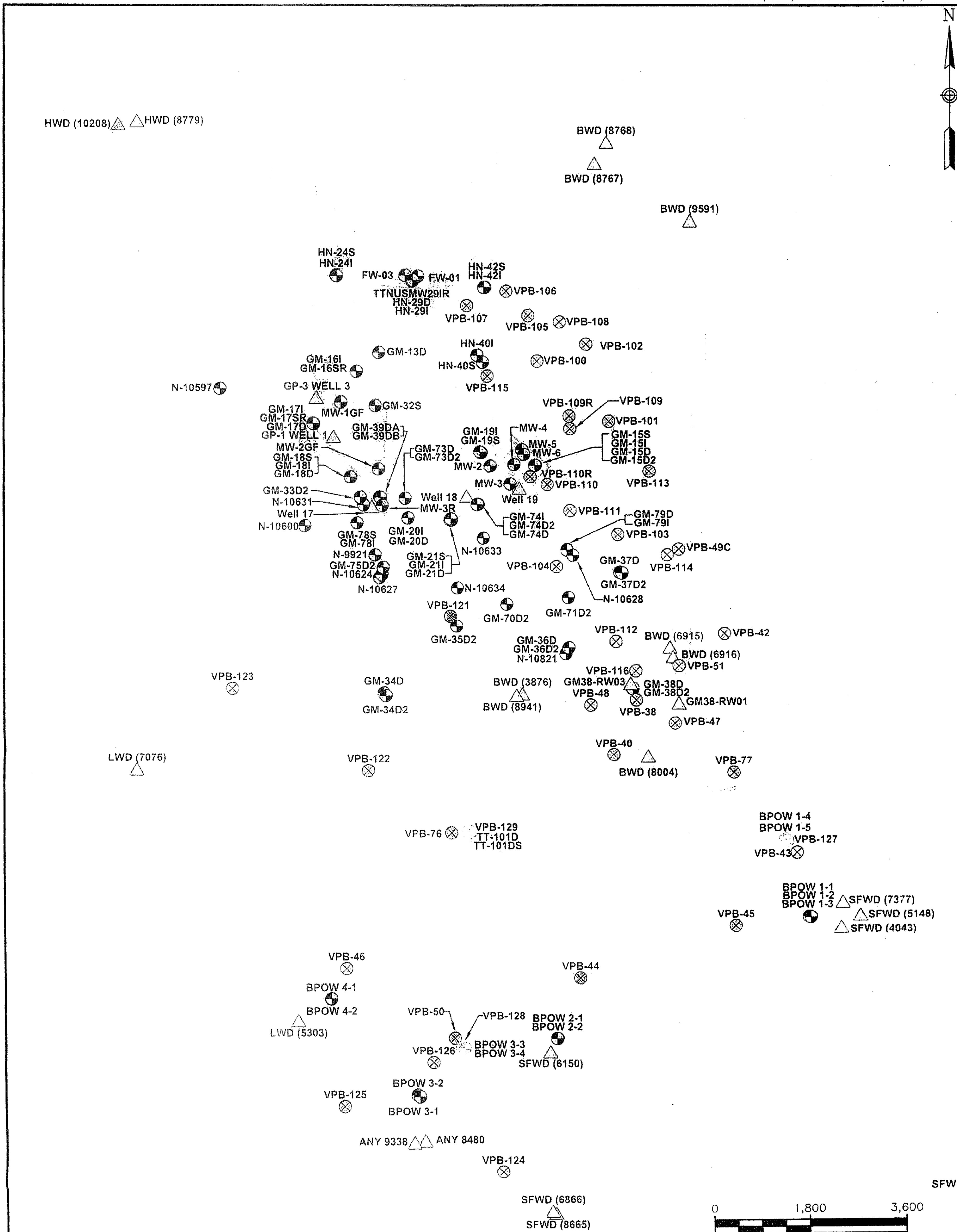
The estimated construction cost, assuming construction begins in 2014, is $2,000,000.

Evaluations of the project budget represent the Engineer's best judgment as a design professional familiar with the construction industry. It is recognized, however, that neither the Engineer nor the Owner has control over the cost of labor, materials or equipment, over the Contractor's methods of determining bid prices, or over competitive bidding, market or negotiating conditions. Accordingly, the Engineer cannot and does not warrant or represent that bids or negotiated prices will not vary from the Owner's project budget or from any estimate of the construction cost or evaluation prepared or agreed to by the Engineer.

APPENDIX A

GROUNDWATER SAMPLING WELL LOCATIONS

112G01041/0275/112G01041GM02 dwg 01/06/11 MKB



0 1,800 3,600

SCALE IN FEET

TETRA TECH NUS, INC.

OPERABLE UNIT 2 (SITE 1)
SITE MAP
NAVAL WEAPONS INDUSTRIAL
RESERVE PLANT
BETHPAGE, NEW YORK

FILE	SCALE	
112G01041GM02	AS NOTED	
FIGURE NUMBER	REV	DATE
FIGURE OU2TT–G1	0	01/07/11

LEGEND

- MONITORING WELL LOCATION
- PROPOSED MONITORING WELL LOCATION
- VERTICAL PROFILE BORING
- PROPOSED VERTICAL PROFILE BORING
- WATER SUPPLY WELL
- 1997 NORTHROP-GRUMMAN BETHPAGE BOUNDARY
- 1997 NWIRP BETHPAGE BOUNDARY
- BUILDING
- HIGHWAY
- MAJOR LOCAL ROAD
- MINOR LOCAL ROAD

APPENDIX B

DAR-1 RESULTS SUMMARY

Town of Hempstead Department of Water

Levittown Water District

Evaluation of Well 13

DAR-1 Analysis of Packed Tower Aeration System

Table 1

DESIGN PARAMETERS FOR WELL 13

PACKED TOWER AERATION SYSTEM

Design Parameters	
Well Number	13
NYSDEC Number	N-05303
Air Flow Rate	5,615 CFM
Water Flow Rate	1,200 GPM
Air/Water Ratio	35:1
Tower Diameter	8.25 ft
Liquid Loading Rate	22.4 GPM/SF
Packed Bed Depth	34 ft
Model Height Above Structure	29 ft
Model Stack Height	44 ft
Stack Outlet Diameter	63 in(1)
Exit Temperature	52° F
Model Exit Velocity	0.01 ft/s(2)
Model Exit Flow Rate	0.01 ACFM(2)
Shortest Distance to Property Line	45 ft
Building Width	22 ft
Building Length	40 ft
Direction Building Length is Facing	90°
UTME	626623
UTMN	4508181
UTM Zone	18

Notes: 1. An equivalent outlet diameter has been calculated to equate to the dimensions of the tower vent ring.
2. At the NCDH's request, exit velocity and flow rate are considered to be negligible due to the PTAS horizontal exhaust condition.

Table 2

3-Year Observed Maximum

Design Compounds	CAS #	Observed Max Influent (µg/l)	Concentration at Property Line (µg/m^3)	AGC (µg/m^3)	SGC (µg/m^3)
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	3.82	0.010	180,000	960,000
Trichloroethene	79-01-6	N/D	N/D	0.2	14,000

Table 3

Design Influent

Design Compounds	CAS #	Design Influent With 1 µg/l Effluent (µg/l)	Concentration at Property Line (µg/m^3)	AGC (µg/m^3)	SGC (µg/m^3)
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	8.6	0.022	180,000	960,000
Trichloroethene	79-01-6	420	1.59 @ 134 ft.	0.2	14,000

Table 4

Maximum Allowable Influent

Design Compounds	CAS #	Max Allowable Influent (µg/l)	Concentration at Property Line (µg/m^3)	AGC (µg/m^3)	SGC (µg/m^3)
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	10,600,000	26,824.917	180,000	960,000
Trichloroethene	79-01-6	52	0.2 @ 134 ft.	0.2	14,000

Table 5

DESIGN PARAMETERS FOR WELL 13

VAPOR PHASE GAC OFF-GAS TREATMENT SYSTEM

Design Parameters	
Model Height Above Structure	10 ft
Model Stack Height	20 ft
Stack Outlet Diameter	20 in[(1)]
Exit Temperature	52° F
Model Exit Velocity	42.9 ft/s
Model Exit Flow Rate	5,615 ACFM
Shortest Distance to Property Line	45 ft
Building Width	22 ft
Building Length	40 ft
Direction Building Length is Facing	90°
UTME	626623
UTMN	4508181
UTM Zone	18

Notes: 1. An equivalent outlet diameter has been calculated to equate to the dimensions of the off-gas treatment vent stack.

Table 6

Design Influent With 95% Reduction From Off-Gas Treatment

Design Compounds	CAS #	**Off-Gas Treatment Effluent (µg/l)**	**Concentration at Property Line (µg/m³)**	AGC (µg/m³)	SGC (µg/m³)
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	0.43	0.004	180,000	960,000
Trichloroethene	79-01-6	21	0.0567 @ 148 ft.	0.2	14,000

APPENDIX C

COST ESTIMATE

TOWN OF HEMPSTEAD
LEVITTOWN WATER DISTRICT
PACKED TOWER AERATION SYSTEM
AT WELL 13
DESIGN REPORT COST ESTIMATE

DESCRIPTION		ESTIMATED COST		
DIVISION 1 - ADMINISTRATIVE/INSURANCE:				
Insurance/Bonds	$	20,000		
Admin/Shop Dwgs	$	15,000		
Testing/Startup	$	10,000	$	45,000
DIVISION 2 - SITE WORK:				
Asphalt Pavement	$	20,000		
Fencing	$	5,000		
Grass Restoration	$	5,000		
Excavation/backfilling	$	75,000		
Demolition/Removals	$	10,000	$	115,000
DIVISION 3 - CONCRETE:				
Clearwell Slabs	$	100,000		
Clearwell Walls	$	100,000		
Baffle Walls	$	15,000		
Clearwell Top Slabs	$	100,000		
Door Pads	$	5,000		
Intake Louver Pads	$	2,500		
Equipment/MCC Pads	$	5,000		
Sidewalks/Curbs	$	10,000	$	337,500
DIVISION 4 - MASONRY:				
Brick and Block Walls	$	75,000	$	75,000
DIVISION 5 - MISC METALS:				
Pipe Supports	$	5,000		
Roof Scuttles	$	3,000		
Access Hatches	$	2,500		
Stairs and Railings	$	5,000		
Stn Stl Ladders	$	2,500		

Structural support steel	$	5,000		
Grating and supports	$	15,000	$	38,000
DIVISION 6 - WOOD				
Roof Trusses	$	15,000		
Other Roof Framing	$	15,000		
Ceiling	$	10,000		
Miscellaneous trim and accessories	$	5,000	$	45,000
DIVISION 7 - THERMAL AND MOISTURE PROTECTION:				
Caulking/Sealant	$	5,000		
Foundation damproofing/Insulation	$	5,000		
Flashing, Gutters, Trim	$	5,000		
Roofing	$	15,000	$	30,000
DIVISION 8 - DOORS AND WINDOWS:				
Single Door	$	2,500		
Windows	$	6,000		
Double Doors and Hardware	$	3,500	$	12,000
DIVISION 9 - PAINTING:				
Valve Tags	$	2,500		
Valve Chart	$	1,000		
Pipe Labels	$	2,500		
Signs	$	2,500		
Pipe Painting	$	5,000		
Floor Painting	$	4,000		
Interior Wall Painting	$	5,000		
Exterior Waterproofing	$	2,500		
Doors Painting	$	2,000		
Ceiling Painting	$	4,000	$	31,000
DIVISION 13 - SPECIAL CONSTRUCTION				
Chemical Safety Panel Modifications	$	30,000		
Flow Switches	$	6,000		
SCADA Modifications	$	65,000	$	101,000
DIVISION 15 - MECHANICAL				
Ductwork	$	20,000		
Fans and Louvers	$	10,000	$	30,000

DIVISION 16 - ELECTRICAL:				
MCC	$	80,000		
Switchgear	$	40,000		
Underground conduit and wire	$	50,000		
Indoor power/control connections	$	40,000		
Heaters	$	15,000		
Indoor lighting	$	7,500		
LIPA Costs	$	20,000	$	252,500
DIVISION 18 - PLUMBING:				
Lime Pumps	$	5,000		
Sodium Hypchlorite Pumps	$	5,000		
Layne Christensen Package	$	250,000		
Tigg Off-Gas Treatment Unit	$	140,000		
Booster Pumps	$	30,000		
Well 13 Pump Modifications	$	35,000		
Buried Pipe and Fittings	$	60,000		
Exposed Pipe and Fittings	$	60,000		
Small Diameter Pipe and Fittings	$	15,000		
Sump Pump	$	5,000		
Valve Operator Extensions	$	7,500		
Cla-Vals	$	15,000		
Venturi Meter	$	25,000		
Drainage Piping	$	10,000		
Flow Transmitters	$	6,000		
Chemical piping and valves	$	20,000		
Air Release Valves and Piping	$	5,000	$	693,500
Subtotal GC, PC and EC Combined	$	1,805,500		
Estimating Contingency at 10%	$	181,000		
Total Estimated Project Cost	$	**1,990,000**		

Town of Hempstead Department of Water

Levittown Water District

Well 13 Packed Tower Aeration System Annual Operating Costs

A. Annual Electric Costs

Off Peak Season			**Peak Season**		
Demand	175	KW	Demand	175	KW
Monthly Demand Charge	$4.65	Per KW	Monthly Demand Charge	$18.96	Per KW
Season Duration	8	Months	Season Duration	4	Months
Total Demand Cost	$6,510		Total Demand Cost	$13,272	
Monthly Operating Hours[1]	240	Hrs	Monthly Operating Hours[2]	300	Hrs
Monthly Usage	42,000	KWH	Monthly Usage	52,500	KWH
Usage Charge	$0.0387	Per KWH	Usage Charge	$0.0477	Per KWH
Total Usage Cost	$13,003.20		Total Usage Cost	$10,017	
Total Electric Cost	$19,513.20		Total Electric Cost	$23,289	
Total Annual Electric Cost of New Water Supply Facilities				$42,802.20	

Notes: 1. Based on average day pumpage and pump flow rates (One well pump, one booster pump, and one blower at 8 hours per day).
2. Based on maximum day pumpage and pump flow rates (One well pump, one booster pump, and one blower at 10 hours per day).

B. Annual Carbon Costs

Annual Carbon Changes	4
Cost of Carbon Per Change	$25,000
Total Annual Carbon Cost	$100,000

C. Annual Costs Associated with 30 Year Life of New Equipment

	Well Pump	Booster Pump	Blower
Rehabilitation Interval	5	5	5
Number of Rehabilitations Over 30 Years	4	4	4
Cost Per Rehabilitation	$5,000	$5,000	$1,000
Total Lifetime Replacement Cost	$20,000	$20,000	$4,000
Replacement Interval (Years)	15	15	15
Number of Replacements Over 30 Years	2	2	2
Cost Per Replacement	$65,000	$65,000	$40,000
Total Lifetime Replacement Cost	$130,000	$130,000	$80,000
Costs Associated with 30 Year Life of New Equipment			$384,000
Annual Costs Associated with 30 Year Life of New Equipment			$12,800

D. Sum of Operating Costs for Project

Annual Electric Usage and Demand Costs	$42,802.20
Annual Carbon Costs	$100,000
Annual Costs Associated with 30 Year Life	$12,800
Total Annual Operating Costs	**$155,602.20**